2969

THE

JOURNAL

OF

GAS LIGHTING,

WATER SUPPLY,

Etc.

VOL. XCIII.

JANUARY TO MARCH, 1906.

LONDON:

WALTER KING,

11, BOLT COURT, FLEET STREET, E.C.

THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. XCIII. No. 2225.] LONDON, JANUARY 2, 1906. [58TH YEAR. PRICE 6d.

PARKER & LESTER,

— *ESTABLISHED 1830.* —

MANUFACTURERS AND CONTRACTORS. **ORMSIDE STREET, LONDON, S.E.**

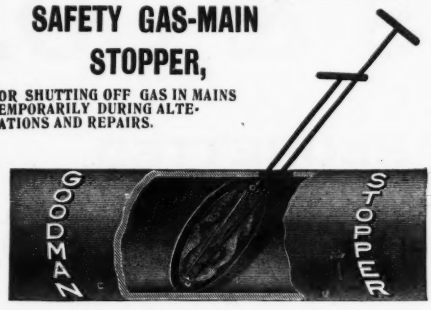
THE ONLY MAKERS OF

PATENT ANTIMONY PAINT & PARKER'S IMPERIAL BLACK VARNISH.

OXIDE PAINTS, OILS, AND GENERAL STORES, FOR GAS AND WATER WORKS.

SAFETY GAS-MAIN STOPPER,

FOR SHUTTING OFF GAS IN MAINS TEMPORARILY DURING ALTERATIONS AND REPAIRS.



SHORT'S PATENT

GAS-LEAK INDICATORS.

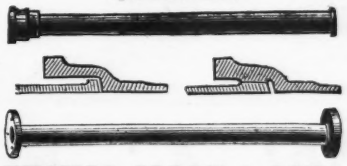
FOR GROUND USE. FLUSH BOXES ETC. HIGHLY SENSITIVE. LONG-RANGE.

FOR PURIFIER BLOW-OFF VALVES. FOR HARD USAGE.

WITH ALL LATEST IMPROVEMENTS.

GAS AND WATER PIPES

1½ to 12 in. BORE.



THOMAS ALLAN & SONS, LIMITED,

Bonlea Foundry,

THORNABY-ON-TEES.

Formerly Springbank Iron-Works, Glasgow

ESTABLISHED 1848.

Also Manufacturers of

SANITARY AND RAIN-WATER PIPES, HOT WATER PIPES, STABLE FITTINGS, RANGES STOVES, AND GENERAL CASTINGS.

Telegrams: "BONLEA, THORNABY-ON-TEES."

NORTON'S PATENT

"ABYSSINIAN" & ARTESIAN TUBE WELLS,

FOR TOWN WATER-WORKS AND OTHER SUPPLIES.

The following Town Water-Works Supplies have been obtained by this System, viz.:—Abbott's Langley, Aldershot, Alnwick, Cirencester, Hertford, Lechlade, St. Albans, Shrewsbury, Skegness, Southampton, Stony Stratford, Swansea, Wallingford, Watford, West Worthing, Wimborne, &c.

LE GRAND & SUTCLIFF,

HYDRAULIC ENGINEERS, 100, BUNHILL ROW, LONDON, E.C.

13,000

FURNACES

FITTED.

CHEAP STEAM PRODUCTION.

TO THE EDITOR OF ENGINEERING.

SIR,—Some years ago we attached forced draught and special fire-bars to our two Lancashire boilers, with the object of burning coke dust. The load has grown, and last week I had the water and fuel carefully checked, with the following results:—

Water used in boilers from Dec. 9 to Dec. 16, as per Corporation meter .	79,300		
Fuel used from Dec. 9 to Dec. 16: Coke	£	s.	d.
dust—41 tons 4 cwt., at 1s. 11d. .	3	19	0
Washed slack—15 tons 17 cwt., at 6s. 6d.	5	3	2
	£9	2	2

This works out at a fraction under 2s. 4d. per 1000 gallons. Can this result be beaten? I may add that the water-feed to the boilers is heated by the exhaust steam from the engines to 200 deg.

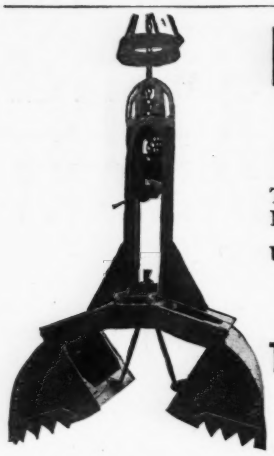
Yours truly,

C. D. LENG.

High Street, Sheffield, Dec. 19, 1904.

FOR FURTHER PARTICULARS APPLY—

MELDRUM BROS., LTD., TIMPERLEY, MANCHESTER; AND 66, VICTORIA STREET, WESTMINSTER.



HONE'S PATENT GRABS

Automatic, Efficient, & Economical.

APPLICABLE TO ANY ORDINARY SINGLE CHAIN CRANE.

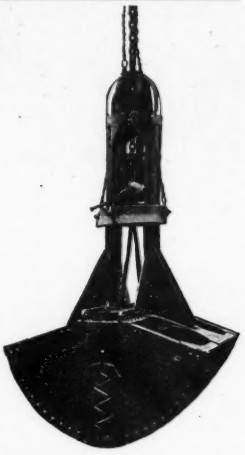
These Grabs are unequalled for handling Coal, Coke, Ballast, Sand, Macadam, Ores, &c., effecting in all cases very substantial savings.

Used by all the Principal Gas Companies, Colliery Owners, Coal Merchants, Engineers, Contractors, &c., at Home and Abroad.

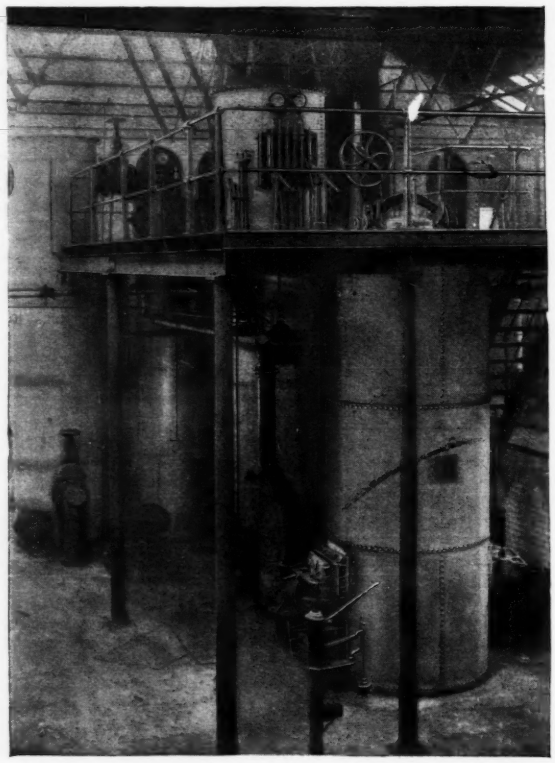
Applications for Prices and Particulars are invited by the Sole Manufacturer—

THE THAMES IRON WORKS, SHIPBUILDING, and ENGINEERING COMPANY, LTD.,

CANNING TOWN, LONDON, E.



W. C. HOLMES & CO.



GENERATING ROOM. Carburetted Water-Gas Plant. Capacity 200,000 Cubic Feet per Day.

MAKERS OF

CARBURETTED

WATER-GAS PLANTS.

"Holmes" Rotary Scrubber-Washer.

PELOUZE & AUDOUIN TAR-EXTRACTORS.

DOUBLE-FACED VALVES.

HORIZONTAL OR VERTICAL FORM.

COMPLETE COAL-GAS INSTALLATIONS.

Works: HUDDERSFIELD.

London Office: 11, VICTORIA STREET, S.W.

HIGHEST AWARDS—LONDON, PARIS, COLOGNE, VIENNA, MELBOURNE, AND OTHERS.

— 11 MEDALS. —

MANUFACTURERS OF TUBES AND FITTINGS OF EVERY DESCRIPTION.

WROUGHT-IRON OR STEEL MAINS UP TO 6 FEET DIAMETER FOR GAS, WATER, OIL, OR OTHER PURPOSES

SCREWING TACKLE, BOILER MOUNTINGS, VALVES, COCKS, ETC.

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108, Southwark Street.	33, King Street West.	114, Colmore Row.	6, Mark Lane, New Briggate.

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Midland Iron-Works:
DONNINGTON, near NEWPORT, SALOP.

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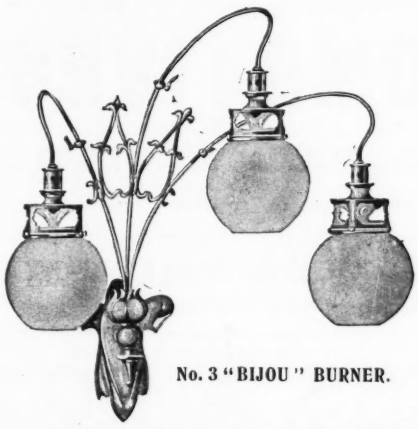
The "BIJOU" BURNER is the neatest, most decorative, and economical ever known, and is the real rival to Electric Light at One-Tenth the cost.



No. 3 "BIJOU" BURNER.

All Mantles we supply are made of best double-woven Ramie, and marked with our Trade Mark,

"NICO."

No. 2 BURNER.

INVERTED FITTINGS OF EVERY DESCRIPTION AND UP-TO-DATE DESIGNS.

The New Inverted Incandescent Gas Lamp Co., Ld.

23, FARRINGDON AVENUE, LONDON, E.C.

Every Description of

FIRE-CLAY GOODS

OF BEST QUALITY ONLY.

Personal attention given to all orders.

MOBBERLEY & PERRY, STOURBRIDGE.

INCLINED AND HORIZONTAL RETORTS of both Taper and Parallel Sections.

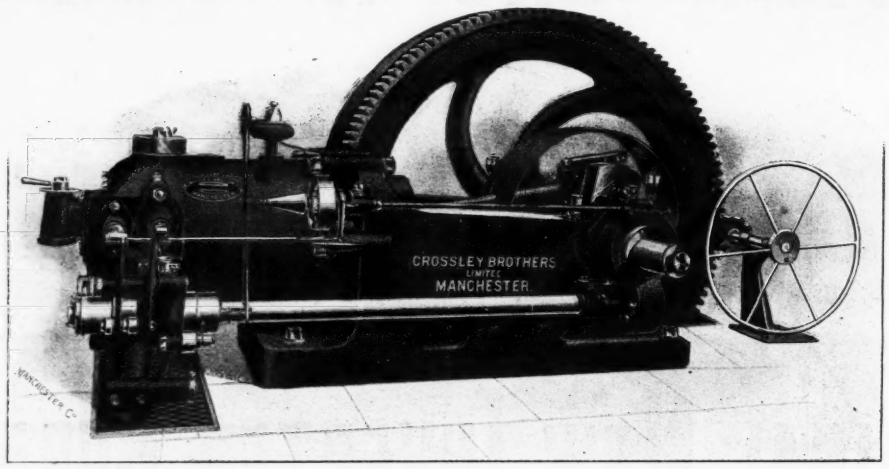
SPECIALS FOR WATER GAS PLANTS

CHECKER BRICKS ALWAYS IN STOCK

LARGE STOCKS KEPT.

CROSSLEY'S GAS-ENGINES

SUITABLE FOR DRIVING EXHAUSTERS, PUMPS, &c.



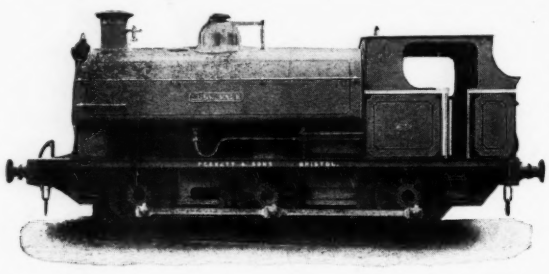
Represents XAE Type High-Speed Electric Light Engine giving 75 Effective Horse Power.

Up to the end of 1904, over 51,000 Gas and Oil Engines have been delivered, representing about three-quarters of a million actual horse power.

IMMEDIATE DELIVERY FOR STOCK SIZES OF ENGINES.

Large Number of Second-Hand Engines always in Stock.

CROSSLEY BROS., LTD., OPENSHAW, MANCHESTER.



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LOCOMOTIVES of all Sizes and Gauges specially constructed for Main and Branch Lines, Contractors, Docks, Gas-Works, Collieries, Iron-Works, Brick and Cement Works, &c. Locomotives of various Sizes always in Stock, ready for immediate delivery.

Photographs, Specifications, and Prices on Application.

PECKETT & SONS, Atlas Locomotive Works, BRISTOL.

Telegraphic Address: "PECKETT, BRISTOL."

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LIMITED.

THORNCLIFFE IRON-WORKS, near SHEFFIELD.

—— Established 1790 ——

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GAS ENGINEERS, IRONFOUNDERS, and CONTRACTORS.

MANUFACTURERS OF EVERY DESCRIPTION OF

PLANT, APPARATUS, AND MACHINERY FOR GAS AND CHEMICAL WORKS.
RETORTS AND FITTINGS, MOUTHPIECES WITH SELF-SEALING LIDS.
IMPROVED COAL AND COKE HANDLING PLANT, CONVEYORS, AND ELEVATORS.
CONDENSERS, SCRUBBERS, AND WASHERS.

PURIFIERS with Planed Joints a Speciality.

PATENT CENTRE-VALVES, RACK AND SCREW VALVES, WOOD GRIDS AND SCRUBBER-BOARDS, CAST-IRON MAINS, AND SPECIALS.
STRUCTURAL WORK, COLUMNS, GIRDERS, AND ROOFING.
GASHOLDERS, CAST-IRON OR STEEL TANKS.

DESIGNS, SPECIFICATIONS, and ESTIMATES FREE.

PIG IRON (SPECIAL QUALITY) for Engine Cylinders. GAS COAL famous for its Unrivalled excellence.

WELSBACH LIGHT

(PATENTED)

Fig. 35. 100 c.p.

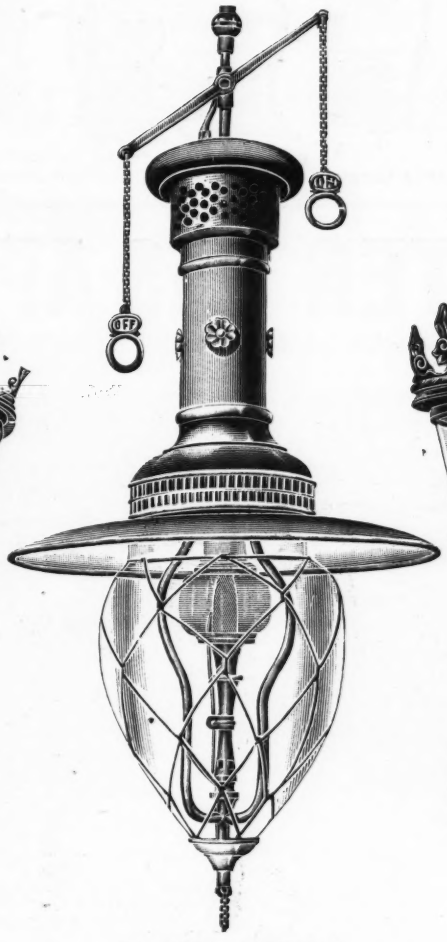

Fig. 607. 600 c.p.
Self-Intensifying.

Fig. 35a. 300 c.p.
Self-Intensifying.

WELSBACH "C," "CX," AND PLAISSETTY MANTLES,

4½d. each, subject.

Thousands of the above Lamps in use and giving satisfaction.

EACH LAMP AND MANTLE GUARANTEED.

THE

WELSBACH INCANDESCENT GASLIGHT CO.

LIMITED

2 to 14, Palmer Street, WESTMINSTER, S.W.

Telegrams: "WELSBACH, LONDON." *Telephone: 290 WEST.*

JOSEPH EVANS & SONS, CULWELL WORKS, WOLVERHAMPTON.

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PLEASE APPLY FOR CATALOGUE No. 8.

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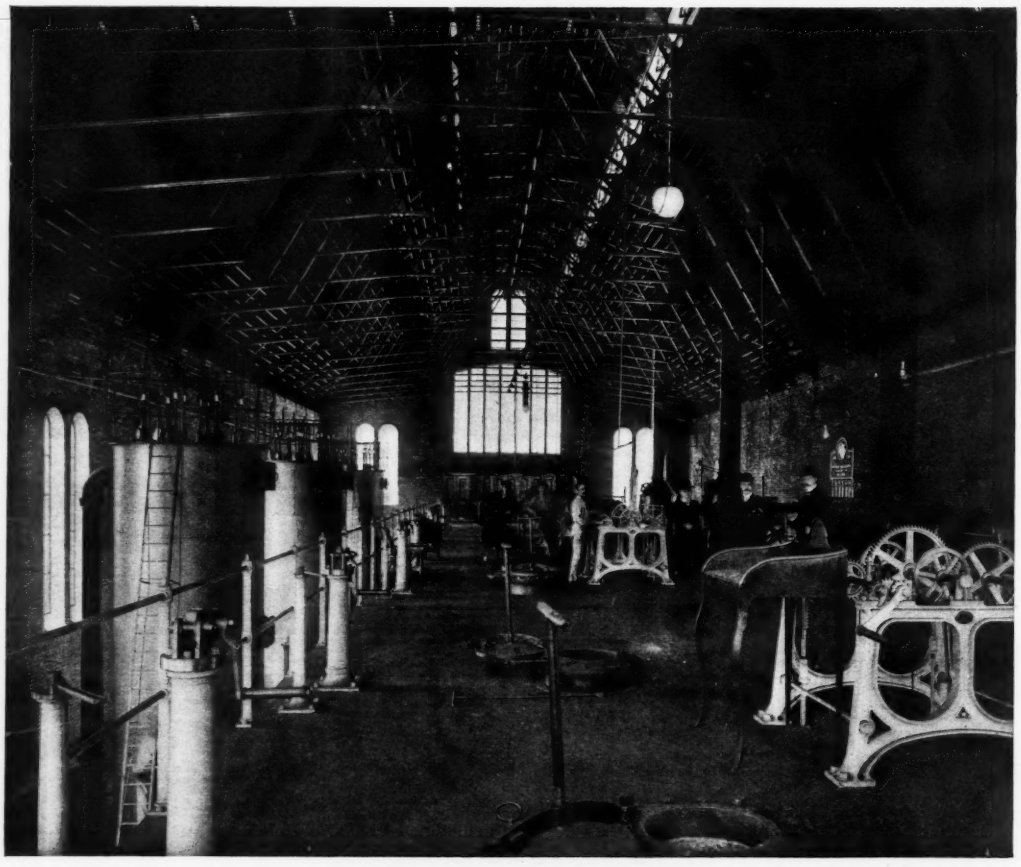
National Telephone No. 7039.

TRADE MARK.
FIRST AWARDS EVERYWHERE.

See next Week's Advertisement for Steam-Pumps, Tar and Liquor Pumps, &c.

BLUE WATER GAS APPARATUS

(DR. KRAMERS & AARTS PATENTS).



The Kramers and Aarts Water Gas Plant at Amsterdam. Operating Floor.

Guaranteed Results per 1000 Cubic Feet of Gas.

Calorific Power, 315 B.T.U. per cubic foot.

Use of Carbon in the Generators, 22 lbs.

Use of Steam in the Generators, 3·3 Gallons.

Percentage Composition	
CO_2	3·5
O_2	0·2
CO	45·0
H	48·0
Difference	3·3

Plants erected since 1902, or in erection, at the following Gas-Works—

	Cubic Feet Daily.
Amsterdam	2,118,000
Zevenbergen	125,000
Breda (Test Station)	425,000
Cadiz	125,000
Venlo	175,000

Offices: P.C. HOOFTSTRAAT 62, AMSTERDAM.

THE "BRAY" INCANDESCENT GAS BURNER

WITH INSIDE BYE-PASS

AND THE

"BRAY" PATENT GAS ADJUSTER.

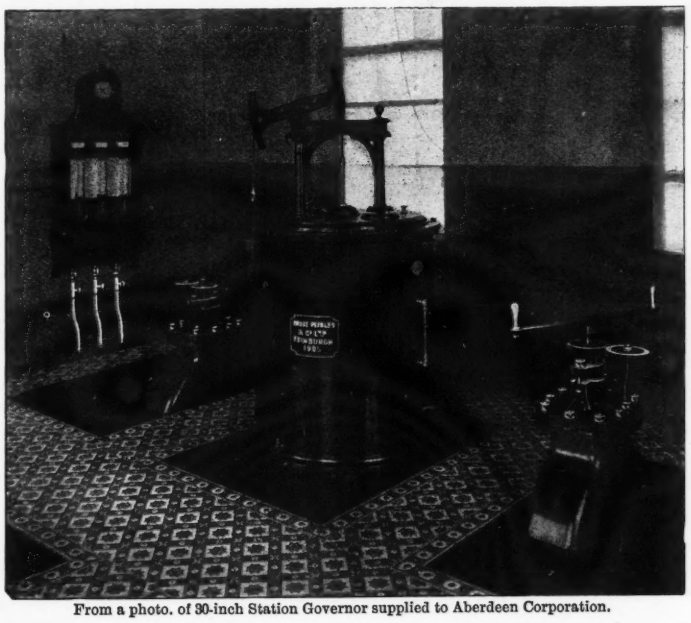
The most economical results can be obtained by using a "Bray" Burner, fitted with the "Bray" Adjusting Screw. It enables the burner to be used with any quality or pressure of gas.

OUR CATALOGUE CONTAINS ALL PARTICULARS.

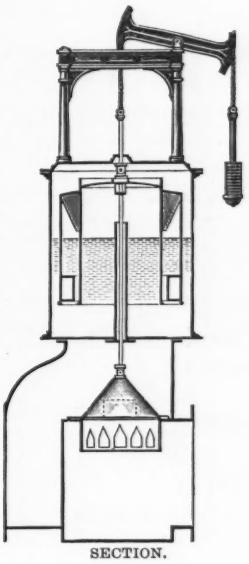
GEO. BRAY & CO., LTD., GAS LIGHTING ENGINEERS, LEEDS.

PATENT SAFETY STATION GOVERNORS.

The result of many years' varied experience in their design and manufacture, they effectually Control Pressure under the most exacting conditions.



From a photo. of 30-inch Station Governor supplied to Aberdeen Corporation.



SECTION.

The Bell is enclosed and in communication with the outlet of the Governor, thus responding to the slightest variation in outlet Pressure. Small weights are conveniently placed for operating the Governor, or "The Peebles' System of Air-Loading" from a distance may be employed. All Governors are carefully tested before being dispatched, and the material and workmanship is of the best possible description.

BRUCE PEEBLES & CO., Ltd.,

Tele rams: "Peebles, Edinburgh." **TAY WORKS, BONNINGTON, EDINBURGH.** Telephone 4244.

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PATENT HYDRAULIC MACHINERY

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SIR WILLIAM ARROL & CO., Ltd., Sole Makers,
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PLANS AND ESTIMATES FURNISHED ON APPLICATION.

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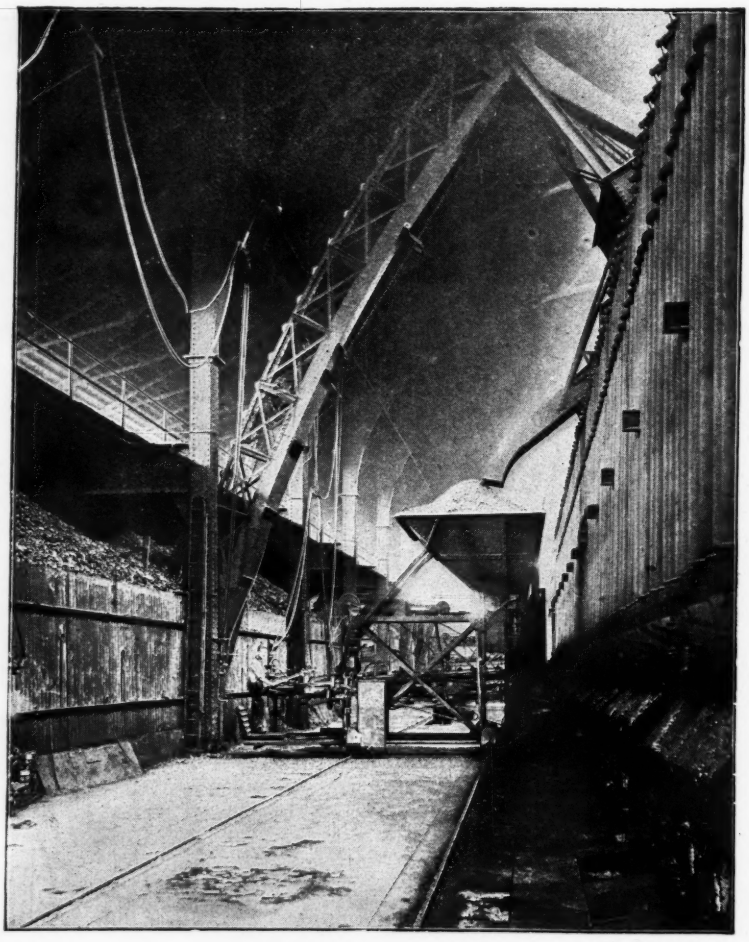
Dawsholm.
Dalmarnock.
GASLIGHT & COKE COMPANY—
Beckton.
Shoreditch.
Bromley.
SOUTH METROPOLITAN GAS COMPANY—
East Greenwich
Vauxhall.
Rotherhithe.
COMMERCIAL GAS-WORKS—
Wapping.
Poplar.
BROMLEY GAS-WORKS (KENT).
EDINBURGH GAS-WORKS.
LIVERPOOL GAS-WORKS.
BRIGHTON GAS-WORKS.



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Are Employed at the following Works—

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&c., &c., &c.

NEARLY
300 MACHINES
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WORK OR IN COURSE OF CONSTRUCTION.

THE TIME TAKEN TO DRAW AND CHARGE EACH RETORT BY THESE MACHINES AVERAGES

UNDER ONE MINUTE.

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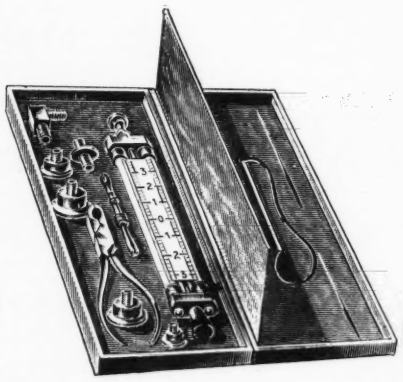

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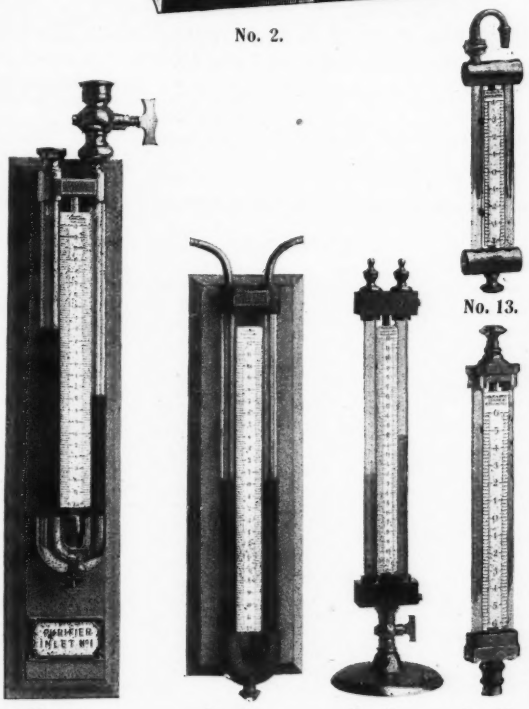

No. 11. No. 12. No. 17. No. 18. No. 13.

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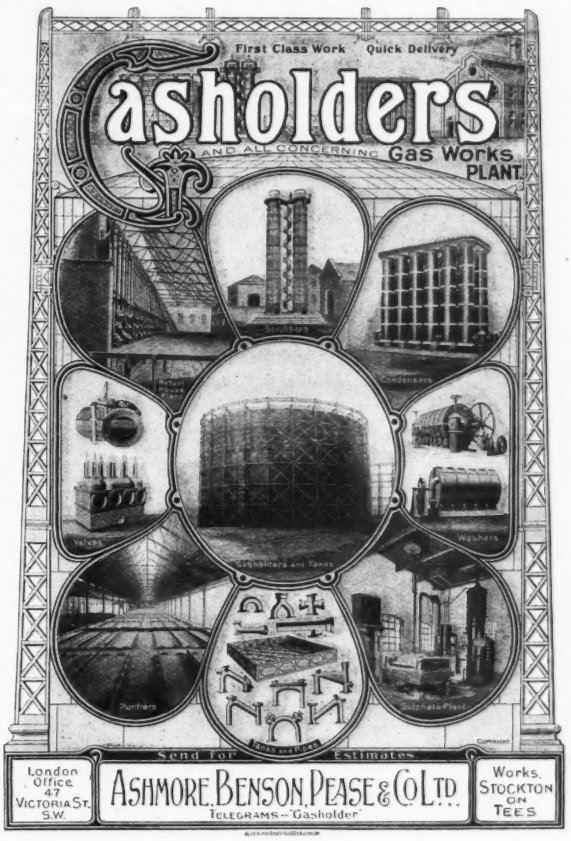
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Telegrams—"Gasholder"
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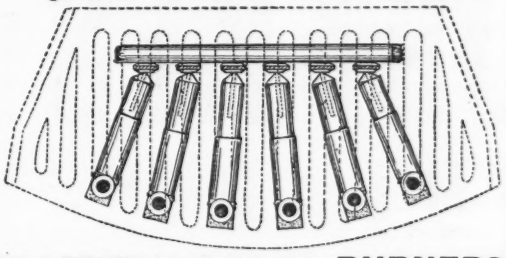
FIT GAS-FIRES TO COAL GRATES

QUICKLY AND AT SMALL COST.



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Can be Adjusted to Shape of Grate and Gas Pressure *in situ*.

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53, KINGSLAND ROAD, LONDON, N.E.

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PATENT TAR-EXTRACTOR

As a Naphthalene Remover.

The Exhaust Steam heats up the Tar and the Gas, and enables it to remove the maximum amount of Naphthalene. By removing the Tar, no Naphthalene is carried forward to the Scrubbers, except in strong and thorough combination with an **EXCESS** of light hydrocarbons, so evenly distributed and always sufficient in quantity to prevent the action of ammonia on the phenols liberating the Naphthalene dissolved by them.

SOLE MAKERS:

ROBERT DEMPSTER & SONS,

ROSE MOUNT IRON-WORKS, *LTD.*,

ELLAND, Yorks.

"STANDARD" PURIFYING GRIDS.

(F. D. MARSHALL'S PATENT.)

THE ONLY GRID WHICH ENSURES THE FORMATION OF SUPPORTING ARCHES.

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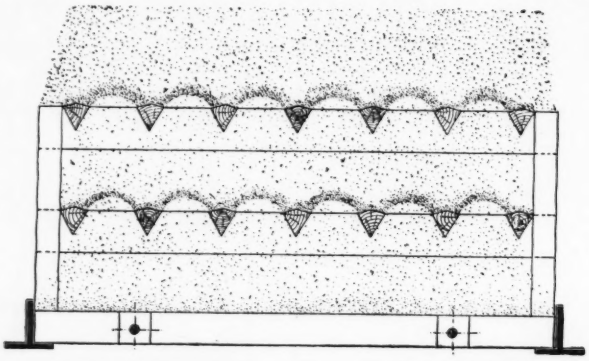
ABERCARN,
ABERYSTWYTH,
ARMAGH,
BARNET,
BECKTON,
BIRMINGHAM,
CHICHESTER,
HAMPTON COURT,
HOLMFIRTH,
ILFORD,
LEA BRIDGE,



Orders Received from—
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LONDONDERRY,
PORT ELIZABETH,
POYNTON COLLIERIES,
REDHILL,
RICHMOND,
ST. IVES,
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KIRKHAM, HULETT, & CHANDLER, LIMITED,
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Sole Agents for the Berlin-Anhaltische-Maschinenbau Act. Ges. Specialities.

THE WIGAN COAL & IRON CO., LIMTD.,

Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

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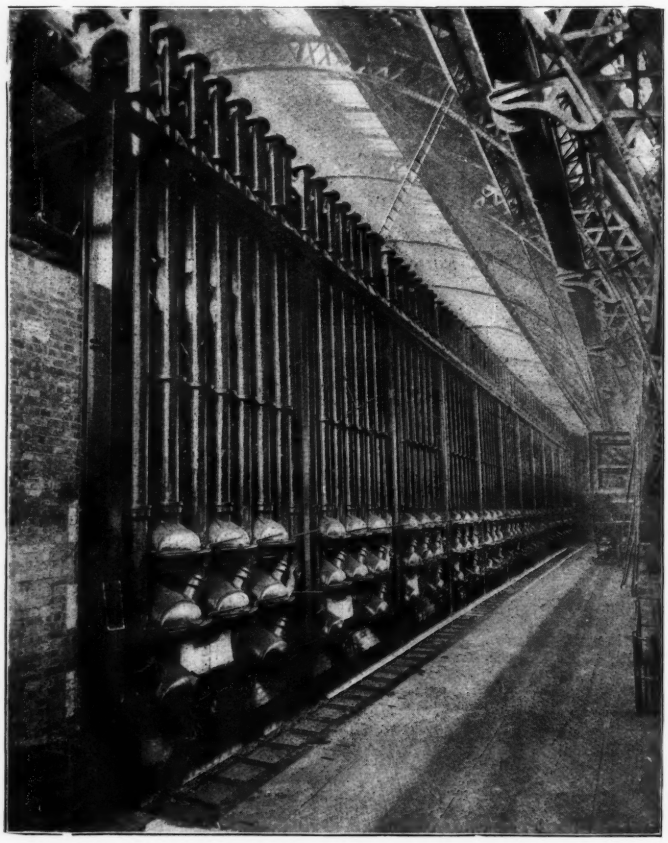
MELBOURNE
31, QUEEN STREET.

Inclined Retort Installation, With Hot-Coke Conveying Plant.



The Chief Astronomical Feature of

1906

WILL BE

THE HEAT FELT FROM

"MARS"!

"MARS," the Gas-Heated Steam Radiator made by ARDEN HILL & Co., "Acme" Works, BIRMINGHAM (under Licence from John Wright & Co.).

IMPORTANT NOTICE.

It is the practice of the "Gas World" to publish from time to time analyses of the accounts of Gas Undertakings in this Country. A number of such analyses appeared in the issue for September 16, and they show that at Fenton, Longton, Rotherham, and Tipton, some of the highest results were obtained in Gas Made and Coke Sold.

It may be interesting to Gas Engineers to learn that at these four places Winstanley's Settings are in use.

The Winstanley Speciality Company, Newton Chambers, Cannon Street, Birmingham.

COAL TAR PRODUCTS.

Benzol, Toluol, Solvent Naphtha, Creosote Oils, Grease Oils, Carbolic Acid, Crude Creosote Salts, Granulated (Crude) Naphthalene, Sublimed Naphthalene, Anthracene, Refined Tar, Pitch, also Sulphate of Ammonia.

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709, OLD KENT ROAD, LONDON, S.E.

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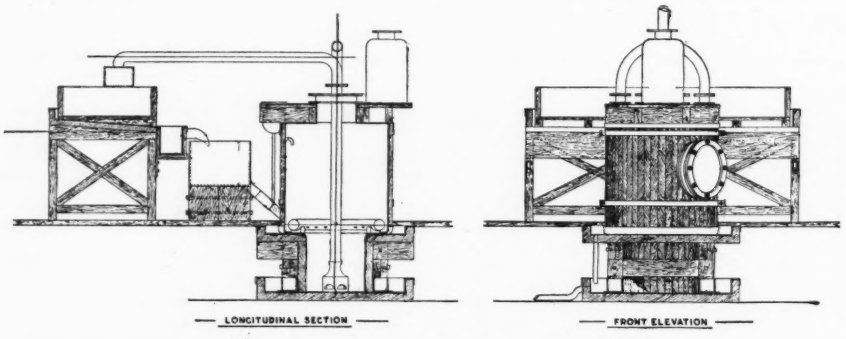

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CONTENTS.

EDITORIAL NOTES.

GAS, &c.—
Non-Statutory and New Companies in Parliament 15
Revised Notification of the Gas Referees . 16
Municipal Virtue 16
Electrolysis 17
Naphthalene Experiences at Sheffield—Vertical Retorts—The Gas Question in Paris—The Workless and the Children—Methods of Charging for Gas—"Charred Coal" and Smoke Abatement—Efficiency of Coke-Breeze Concrete—Rickmansworth Gas-Works Purchase—The Steam-Roller Again—High-Pressure Distribution—Injury Caused by Pumping Operations 17

The Notification of the Gas Referees for 1906 20
Electric Lighting Memoranda—Retrospect of the Year 21
The Iron and Steel Trades in 1905 23
An Admission of Municipal Failure . . . 23
Gas Stock and Share Market 23
Gas Bills for 1906 24
Vertical Retorts for the Production of Illuminating Gas. By W. R. Herring, M.Inst.C.E. 26
Naphthalene at Sheffield. By Hanbury Thomas 26
Paris Suburban Gas Supply. 27
Charred Coal. By W. D. Scott Moncrieff . 28
Voluntary Winding Up of Messrs. Graham, Morton, Limited, and the Founding of a New Firm 29
Effects of Fire on Coke-Breeze Concrete . . 30
Vertical Retorts for Producing Coal Gas and Water Gas 31
Wilson's Apparatus for the Analysis of Flue Gases 31
The New Instructions of the Metropolitan Gas Referess—Many Important Changes . 34
High-Pressure Gas Distribution of To-Day—Where the System is in Use 40
Electrolysis—The Attacking of a Water-Pipe Results in Lead Poisoning 43

CORRESPONDENCE.

Methods of Charging for Gas 45

LEGAL INTELLIGENCE.

High Court of Justice—King's Bench Division—Fletcher *v.* Mayor, Aldermen, and Burgesses of Birkenhead 46
Compensation for the Fatality at the Fulham Baths 46

MISCELLANEOUS NEWS.

Joint-Stock Company Liquidations Last Year 46
Increased Gas Consumption in Manchester . 46
The Gas Question in Paris—The Present Service to be Continued under Municipal Supervision 47
The Steam-Roller and a Gas Explosion . . 47
Cost of the Rickmansworth Gas-Works . . 47
The Fatal Gas-Works Accident at Birmingham 47
Lighting of the New City Hall, Belfast . . 48
The Operations of the Power Gas Corporation 48
Cape Town Water Supply—Inauguration of a New Reservoir 48
Ilkeston and Heanor Water Supply—The Works of the Joint Water Board. . . . 49
Stock and Share List 49
The Dry Weather of the Past Month . . . 51

MISCELLANEOUS NEWS (*continued*)—
Notes from Scotland 51
Current Sales of Gas Products 53
Coal Trade Reports 54
Gas-Mantle Amalgamation in Germany . . 54
Improvement of the Paris Water Supply . . 55

PARAGRAPHS.

Copper Sulphate for Purifying Water . . . 19
Midland Junior Gas Engineering Association—A New Coalfield in Colorado 20
Application of the Incandescent Mantle to Gas Analysis. 22
The Lewes Self-Carburetting Patent Void in Germany 24
Russian Gas Supply in Present Day Times—Laying Concrete under Water 32
Obituary and Personal 33
Electrolysis of Gas and Water Pipes—Gas-Engines for Working an Elevated Railway. 33
The "Question-Box" of the Ohio Association 42
Water Gas "Smells" at Oldham 45
Electric Light Failure at Weston-super-Mare 48
Assessments in Shoreditch—Water-Works Extensions at Brighton 53
Asphyxiated by Gas—The Escape of Chemical Refuse from the Coventry Gas-Works . . 54
Meter-Rents at Malton—Opposition to the Portsmouth Water Bill—Lincoln Water Supply—Christmas Shopping in the Dark—Shipley Water Supply—A Big Water-Power Electrical Project 55
Sales of Shares—Reduction in the Price of Gas for Power at Eastbourne—Penzance Water Supply—Barnstaple Electricity Undertaking and the Public 56

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EDITORIAL NOTES—GAS, &c.

Non-Statutory and New Companies in Parliament.

WITH the break of a new year, one of the first duties is to make a closer examination of the projected Private Bill Legislation affecting the gas industry than is possible from the mere adumbrations that the Parliamentary Notices of November permit. Copies of the Bills were available in good time on this occasion, thanks to the friendly aid of the Parliamentary Agents; and to-day our customary review commences in subsequent columns with the Bills promoted by new, and already operating limited, Companies for incorporation and statutory powers. The Bills in this group are, for the coming session, few in number—all told, there are only five; but their smallness in quantity is compensated by their exceptional quality, which, in several respects, will captivate interest throughout the session. One cannot explain with any assurance why there are so few non-statutory gas companies in Parliament this year. But such companies have a just grievance against the Legislature. That they should bring themselves and their businesses under statutory regulation is to the interest of the communities they serve, by the strengthened position which it gives the companies, and which enables them to work to the greatest possible advantage within the limits of their operations. There is, however, in the path to this very salutary proceeding, the ever-present uncertainty of the imposition, at the instance of a local authority, of that monstrosity—a purchase clause. The Hitchin Gas Company succeeded in one House last session in defeating that which is regarded, and pleaded for, as a prescriptive right, but in favour of which there is not a shred of justice or shadow of public benefit to advance. The Hitchin Company, though making a brave fight in the second House, did not succeed in breaking down the obstructive custom. Hope may consequently have been abandoned in many cases, although it must not be overlooked that, in the Hitchin case, the terms on which the clause was conceded in the second House were such that the bargain on the part of the Local Authority will not, in the event of their Bill going through this year, be to them and their constituents so richly advantageous as they evidently expect. This may be a cause of regret, so far as the gas consumers go; but there is such a thing as gruesome examples having a widespread virtuous effect. However, this does not alter the fact that obtrudes itself into any consideration of this subject, that the danger of being dispossessed of their property is responsible very largely for an amount of impotence and forced passivity that, against the will of those governing the non-statutory concerns, impedes their progress to a more substantial and advantageous state for all concerned, whether as consumers or as shareholders. We can only continue to hope that before long the scales will be removed from the eyes of our legislators, and that the truth of this will be perceived, and the disability removed.

It has already been said that there are proposals in the few measures under notice this week that will captivate interest. The trend to a lower illuminating power gas continues; and, in fact, a Bill that prescribes an illuminating power above 14 candles nowadays is one worthy of special note. In four out of the five Bills under review, 14 candles is the illuminating power that it is proposed shall be prescribed; and in the fifth—the Truro Bill—13 candles for "coal" gas is desired. Connected with this, it is clear that the courtesy of the Metropolitan Gas Referees in allowing an early publication of their intentions respecting the burner that they have specified for the testing of the gas of the three London Companies has had due effect; for two out of these five Provincial Companies have taken advantage of the knowledge. In the Crediton Bill, a clause appears that will give to the Company all the advantage that the London Companies have secured in the matter of a uniform and fair test for the illuminating power of their gas; and the Truro Gas Company have adopted the South Suburban Company's clause, as published by Sir George Livesey, practically in its entirety. It is a pity that, in the other three Bills, the old diversity of testing method appears, as no opportunity should be lost in trying to secure uniformity.

The Crediton and the Truro Bills have been drawn with a full conception of the needs and inclinations of the gas business. While the other Bills endorse the modern tendency of Parliament to set an arbitrary limit to freedom in contracting for large custom by imposing discounts not exceeding 10 per cent. for prompt payment, and 15 per cent. for large consumptions (notwithstanding the value given for money to the small consumers for illuminating purposes through the incandescent burner), the Crediton and Truro Companies are asking to be released from an unnecessary servitude to Protectionist principles. They are content to have their own and other gas undertakers' areas protected; but within those areas, they want Free Trade between themselves and their customers. The Crediton Company propose up to 10 per cent. for prompt payment, and for large quantities upon such scale and subject to such conditions and regulations as may be prescribed by special contract in writing between the Company and any large consumers. The Truro Company propose a discount not exceeding 25 per cent. for prompt payment; and for large consumptions the same liberty that the Crediton Company are seeking is also desired. An opinion as to the degree of discount for prompt payment need not be expressed here; it will never exceed what is necessary for effecting its purpose. But, for large consumptions, we hope the Companies will struggle, if there is any resistance, for the right to freedom in the conduct of their business so that they can meet their competitors on level ground. It is not right that Parliament should inflict restraint on one competitor only; for that is what the strict regulation of gas discounts amounts to in these days of private gas producers and almost unfettered electricity supply. If this regulation of discounts had its origin in any desire to defend the consumers against unreasonable contracting on the part of gas companies, latter-day knowledge, new arrivals among the competitors, and the divers manners of using gas, are eloquent of the fact that the regulation had its birth in ignorance, and has been fostered in heedlessness of the effect.

Hinging upon this question of freedom in contracting, the Truro Gas Company are also asking authority to give a separate supply of power gas, "having a distinctive and readily "perceptible smell," at 1s. 6d. per 1000 cubic feet of gas with a calorific power of 250 British thermal units, and 1d. additional for every increase of 25 units. This proceeding is significant in two respects. First, there has been (as the gas industry were some time since made aware) established at the Truro Gas-Works a methane-hydrogen plant; and, secondly, throughout the Bill where power gas is not mentioned, "coal" gas is, in contradistinction, named as the ordinary supply. While the Bill is in its present stage, it would ill-become us to fully discuss the question of the economic advantage or otherwise of a dual supply of gas—the one supply possessing a much lower calorific value than the other. Circumstances, of course, alter arguments even in relation to the supply of power gas; and the Truro Gas Company may be fully justified by their conditions in the plan they propose to adopt. It may be taken that the figures are only given as a working basis. But in towns better circumstanced, the price named is the one, or thereabouts, to which the gas suppliers have set themselves to attain for power purposes through the ordinary supply of higher calorific value; and many have done so. Their environment, however, is more propitious than that of the Truro Company. The conditions at Truro as these: There is the methane-hydrogen plant in operation, and from it Mr. Ingram, the Company's Engineer, can run a separate main direct to a district (as Mr. Tully was telling the members of the Irish Association last August) in which are assembled a number of

gas-engines; and he can in this way supply to those engines gas of from 350 to 400 British thermal units at about half the cost of coal gas. We are expecting, however, to hear (if the Bill passes) that the standard figures of 1s. 6d. and 250 British thermal units will not for long have any particular relationship. In comparison with these figures, the Matlock and District Gas Company's Act of 1904 specifies 6d. per 1000 cubic feet of gas of 125 British thermal units, and 1d. for every additional 25 units.

Turning, now, to a few miscellaneous features of the Bills. There is one measure that comprehends a large scheme of purchase of small gas undertakings and their combination as one concern, under the title of the Mid-Oxfordshire Gas Company. Agreements have been entered into for purchase, and they are scheduled to the Bill. The provision in relation to the capital powers of the new Company is noticeable. The money to be expended by them in executing the powers of the Act is not (so runs the clause), *save with the consent of the Board of Trade*, to exceed in the aggregate £70,000. Relating to capital, there is no mention in the Bill as to the manner of disposing of the profits of the Company; the only reference to the subject being that the interest on borrowed money is not to be higher than 5 per cent. Looking at some other general features of the Bills under notice, there is a growing uniformity in respect of the excess charges for prepayment supply, in accordance with the precedents of the last two sessions. The clause is now also commonly adopted which specifies that erroneous registration of meters "shall be "deemed to have arisen during the then preceding quarter." Companies, too, are more frequently taking power to apply for Electric Lighting Orders or Licences. In this connection, an interesting position has arisen at Crediton. A private firm hold an Electric Lighting Order, which should have been transferred to a registered Company before Aug. 15 last. The time having expired, the Gas Company are, in their Bill, asking to be authorized to undertake the supply of electricity. The District Council at first endorsed the action of the Company. But they have since reconsidered the matter, and are now going to support an application for a renewal of the Order on the part of the present holders. In view of the recent notification of the Board of Trade, that they no longer intend to be played with by the promoters of these undeveloped Orders, it will be interesting to see what treatment they will accord the former possessors of the electricity supply rights in Crediton—more especially seeing that it was not until the Gas Company moved that a sense of their duty appeared to dawn upon them. The privilege of supplying electricity in Crediton cannot be worth much; and this may account for the failure to transfer the Order to a registered Company within the specified time.

[In next week's issue, the Bills of the Statutory Companies applying for extended powers will be noticed.]

Revised Notification of the Gas Referees.

An important feature of the technical matter in the present issue of the "Journal" is, in view of the events of the past year, the new notification of the Metropolitan Gas Referees, in which are defined the appliances and apparatus and the methods for testing gas in the Metropolis. The considerable changes that the London Gas Act of last session have introduced have, of course, rendered imperative the entire revision, and in fact reconstruction, of the notification; and in its new textual form it therefore bears little resemblance to its precursors. That the new notification is only to hand on the day that the provisions of the London Gas Act come into force is pardonable, inasmuch as the altered conditions have involved the Gas Referees in an amount of work that all who examine critically the contents of the notification will fully appreciate. The extensive alterations that have been made in the appliances for, and modes of, testing have necessitated not a mere redrafting of the prescriptions on the part of the Referees, but, precedent to the redrafting and the laying down of the new rules, a vast amount of experimental work has been entailed. Appreciating this, it must be freely acknowledged that the Referees have lost no time; and that, so far as a hasty inspection enables the pronouncement of a judgment, they have faithfully performed the duty devolving upon them, and in an impartial spirit. Positive criticism is, of course, out of the question, until daily investigation in actual practice by different observers is at hand, to determine whether the prescriptions are unimpeachable. With regard, however, to the "Metropolitan" argand burner No. 2 (as devised by Mr. Charles Carpenter) which has been instituted for penalty testing, there is satisfaction in knowing that it is the deliberate adoption of the three Metropolitan Gas Companies and of the Gas Referees. The testings of gas for the illuminatimg power by a flat-flame burner and for calorific value have caused an extension of the notification. The standard flat-flame burner that has been prescribed is Bray's No. 7 economizer, fitted with a No. 4 regulator; and for the tests for calorific value, Professor Boys' calorimeter (at which he has been working assiduously for some months past, and which has been lately fully described in the "Journal") has been established as the standard instrument. These testings with the flat-flame burner, the calorimeter, and for sulphur impurities other than sulphuretted hydrogen, however, will only have, as it were, an academic interest, seeing that the Act decrees that they shall be made "for information only" as directed by the controlling authority. These tests will involve a great deal more work on the Gas Examiners; and whether the value of the results will justify that work remains for the determination of experience. In other parts of to-day's issue, the new sections of, and several of the illustrations appearing in, the notification are published; and on p. 20 will be found a compendious statement of the changes that have been made and of the rules and methods to govern the testings as laid down by the Referees. This latter we hope and believe will be found serviceable as an introduction to the study of the notification itself.

Municipal Virtue.

The elevation of Mr. John Burns to the Local Government Board has given a fillip to municipal enthusiasm. Of Mr. Burns as a man, nothing but good can be said; of him as a participator in civic government, it need only be remarked that moderation has not been a striking trait. He has been a member of, and a leader on, the London County Council and the Battersea Borough Council. But neither of these bodies can claim to be a "shining light" in civic polity; and well the ratepayers know it. The only curb that has been exercised on these and similar bodies—and it has not been a very effectual one, as is exposed by the weight of debt and rates—has been that imposed by the Local Government Board. But with Mr. Burns there as President, even the slight restraint that the Board have hitherto exerted has in all probability been taken away. We shall be pleasantly surprised, and not alone, if it should prove otherwise. The President himself bids us hope in his own reformation, and a more assiduous attention on the part of his department to the interests of the ratepayers. He has been addressing his constituents at Battersea, and treated them to a speech constructed of platitudinous statement, with here and there a little pointing that arrests attention. In the latter we find that, from the new President, "private "enterprise will get fair play and just treatment; municipal "activity will be similarly treated." If the declaration of the presidential dogma in this regard had stopped there, well and good; but it did not. Mr. Burns's work is to extend to relieving municipal government from "the conscious bias"—these are solacing words for the libertines in municipal management—"that has operated against it too long." Of course, it will depend upon the way the President sets to work in this matter; but as he speaks of the "conscious bias" that has operated against municipal activity too long, it is clear that he starts on his gratuitous task with a considerable amount of prejudice that is not conspicuously favourable towards those who have cherished the "bias" which he now seeks to relieve. However, may success follow the essay. Mr. Burns is a man strong in ideals and promises. He engages now to give to the patient ratepayers municipal accounts presented in such a way that "he who runs may "read." If the occupancy by Mr. Burns of the office of President of the Local Government Board produces this, we may even see the President himself constrained to acknowledge that deceptive account-keeping by Municipalities is more general than he, at whose feet Sir Henry Campbell-Bannerman would sit to learn of municipal affairs, cares at present to openly confess he is cognizant of. That there are very many municipal bodies whose methods are in the eyes of Mr. Burns somewhat distant from virtuousness in this respect, is made as plain as the dome of St. Paul's by the

reference he has drawn, and the Committee that he is appointing, with the specific object of changing the esoteric character of municipal accounts—particularly, we hope, in those departments in which trading is conducted.

There is not the slightest doubt that the London County Council fully believe in their own importance. More than once lately we have had Sir Edwin Cornwall, the Chairman, speaking "in the name of the people of London," as though there were no other representative bodies in the great Metropolis. Sir Edwin's estimation of the magnificence of the Council is not that of the ratepayers generally; but if his valuation gratifies the Council, it does nothing more than amuse the people, who have constantly in mind the ponderous and mocking debt of the Metropolis. Lest the glory of the thing should have been taken from the Council by any consultation with the other elected bodies of London, Sir Edwin has sprung upon them, through a communication first addressed to the *Neues Wiener Tagblatt*, a scheme for a congress of the municipal representatives of the capitals of the whole civilized world, and has invited the municipal bodies concerned to accept London as the first meeting-place during this year. It is easy to imagine that such a congress might be very beneficial from an international point of view. But we want a little regeneration at home before anything otherwise beneficial can accrue from the wandering of our representatives from country to country to see work that only their specialized officials can comprehend, and to hear unctuous sentiment poured out in tongues that for the most part the members themselves cannot really understand. Sir Edwin, in the notification of his scheme, says that he believes the County Council have not as yet attained the limits of their usefulness. There are not a few who wish that they had; and, as there has been experience of steamboats and of tramways, abortive but expensive attempts at legislation, and what not, we have no particular desire to see the limits extended. An example or two of what Sir Edwin has got in mind is seen in his complaint that the Council have no part in the lighting of the Metropolis with gas and electricity; and they have hardly any voice in the control of the water supply. His communication contains a lot of idle fancies, of which the foregoing are not the least. To the present there has been no evidence of an enthusiastic reception of Sir Edwin's scheme in other capitals. Perhaps the municipal bodies of capitals abroad have now a better knowledge of our County Council than they had before. However, there may be more heard of the matter after the visit of the London councillors to Paris in February, as the guests of the Paris Municipal Council.

Electrolysis.

In 1902, Mr. W. H. Humphreys, the Engineer to the York Water-Works Company, on the strength of the observations he had made on his own distribution system, earnestly advised the British Association of Water-Works Engineers to take the initial steps in securing a conference with the Institution of Gas Engineers on the important subject of the injury to gas and water pipes through vagrant electric currents. The suggestion fell flat among the water engineers, for no apparent reason, unless it be that so many members of the Association, being the officials of municipal bodies who own electrical systems, could not be parties, even in the interests of their own departments, to any steps which might ensue in any effective protective action as against another municipal department. Mr. Humphreys' paper was a valuable one, in that it set forth the history (up to the year of its reading) of the agitation for better protection. Since that time, very little has been accomplished, through the obstinate belief of the Board of Trade in the sufficiency of their own regulations, and through an inscrutable objection on the part of electrical undertakers—assuming the correctness of their declamations as to the adequacy of those regulations—to any specific provision in their Acts for the protection of other occupants of the subsoil. Their insistence rather denotes a vision of the sword of Damocles. When, by dint of perseverance on the part of the owners of subterranean pipes, a protective clause is inserted in a Bill by a Parliamentary Committee, the promoters energetically take steps to get it expunged before the Bill arrives at the status of an Act. In, for example, the Administrative County of London Company's Electricity Bill last session, an electrolysis clause was inserted; the reintroduced Bill for the coming session shows that the clause has been removed. And it will be the duty of the London Gas Companies and the Metropolitan Water Board to fight for its reinstatement or to obtain its insertion in such other of the Power Bills that may—if the Bills are not shelved for the purpose of a general inquiry by a Commission—be passed.

That the neglect of the British Association of Water-Works Engineers in 1902 to pursue this question was not in the best interests of their undertakings, or of their consumers, is convincingly illustrated by the paper that Mr. Baldwin Latham read at the recent meeting (published in this issue), in which he showed that escaping current from an electric-lighting system had been the cause of electrolytic action on a lead water supply pipe, and had produced a case of lead-poisoning. The seriousness of this, the members at once recognized. This having happened in one case, it is pertinent to ask, What may be going on elsewhere? The South Hants Water-Works Company, in whose district this case occurred, are to be commended for the action they took to determine the cause with the conclusiveness that they did. But having now arrived at the cause, the next thing is the prevention of this public danger. Regulations are one thing; their strict observance is another. And protective clauses would have effect in ensuring observance in a manner that nothing else will do. Mr. Baldwin Latham's paper emphasizes, says the "Electrician," the importance of earthing in an effective manner, at the generating-station, the negative pole of an uninsulated return system of private house wiring. "*If* this precaution is taken, and "the installation is otherwise carried out in a satisfactory "manner, there is no likelihood of any electrolysis occurring." The excellence of the argument for protection is confirmed by the virtuous "if" and by the subsequent proviso in this quoted sentence. In the same issue of our contemporary, a correspondent shows that the omission of "a necessary pre-"caution in his network—viz., that the lead sheathing of "his cables should be continuous throughout"—also led up to difficulty. The owners of underground pipes ask that there should be imposed what is necessary to assure to them that every precaution in electrical installation in the subsoil is taken, and that satisfactory work is put in, to shield their distribution systems from this form of destructive and debilitating influence, as well as life from danger. In the "Journal" and in the Parliamentary Committee rooms, illustration after illustration of damage to pipes by escaping electric currents have been presented; Mr. W. G. Peirce, of Richmond, at the meeting of the water engineers also exhibited samples of lead pipes that had been perforated by electrolytic action in his district; and Mr. Easton Devonshire related a case that had occurred in the Antwerp water-works system. Not many years since, we saw some samples of gas-pipes at Southampton that had similarly suffered. Perhaps Mr. William Matthews, the Corporation Water Engineer, could, if he had chosen, have also advanced, at the meeting of water engineers, illustration of similar damage to the borough water system. The members unanimously resolved to lay, as an Association, the full facts connected with this serious South Hants case before the Board of Trade and the Local Government Board. If the paper and the reports of the experts have a softening influence on the Board of Trade, good service will have been rendered to the owners of underground pipes generally.

Naphthalene Experiences at Sheffield.

An instructive article, and one that is not likely to lead to controversy, excepting perhaps on incidental conclusions, is published to-day from Mr. Hanbury Thomas. As we have heard time and again from Sir Frederick Mappin, the Sheffield Gas Company are among those who (in this case from towards the end of the eighties) have been afflicted by an atrocious amount of trouble from naphthalene. But now, through the adoption of the Derby oil-washing process at two of the works, and the Leicester process at the third works, the officials during the past year have, to quote Mr. Hanbury Thomas, "enjoyed such peace of mind as has not been known to them for a considerable period, and they look forward with hope to being spared the anxiety and never-ceasing worry which they have been accustomed to endure for many years." As regards the relative effectiveness of the two systems, the figures give the information; and our contributor emphasizes what an examination of the

statistics discloses, that, from the Sheffield experiences, there does not appear to be much to choose between the two, as, though the Neepsend figures (Bell process) show a rather larger proportion of complaints to the number of consumers than Effingham Street (Colson process), the Grimesthorpe figures are more favourable to the Derby process. Working out the averages to per 1000 meters, this statement is borne out; and it would be of interest to know if any explanation has been found as to the reason. It would also be interesting if Mr. Hanbury Thomas would supplement his information by telling our readers whether there is any intercommunication between the districts—whether any of the gas from either the Neepsend or Grimesthorpe works finds its way into the Effingham Street district, or from the Effingham Street works into the Neepsend and Grimesthorpe districts. In connection with this naphthalene problem, experiences vary so much that theory is constantly receiving violent shocks. Some of the experiences at Sheffield are peculiarly noteworthy. When naphthalene first appeared, no alteration whatever had been made in the method of carbonizing over that of previous seasons. It was subsequent to the advent of naphthalene troubles that regenerative furnaces were started, and later on stoking machinery. And the figures in the second table show that it was still some years after this that the three most terrible years of the trouble were experienced, although in those years the make of gas per ton of coal carbonized was, if anything, a little below the average. Following, too, the return to higher condensation temperatures, the numbers of complaints have not been so high as when condensation at lower temperatures was in vogue. However, the point of the article is that Sheffield has, by the Derby and Leicester processes, been relieved of a terrible nuisance.

Vertical Retorts.

In another part of this issue, we have what we anticipate is the first of several articles from the pen of Mr. W. R. Herring on the subject of vertical retorts. In going across the Border, the author has been brought into somewhat intimate contact with the scientific application of the vertical retort system in the shale-oil industry of Scotland; and what we have now brought before us supplies, in the first place, a lesson as to the necessity for a little less industrial exclusiveness. We are prone to become so wrapped up in the work of our own industry, that that of kindred industries is altogether excluded from sight, and, it is conceivable, at times to our disadvantage. We do not say that it is so in this instance; but it is indicated that what Mr. Herring is going to communicate will show that there has been a considerable amount of experimental work done in connection with vertical retorts in rendering them suitable for coal-gas production that has already been covered by what has been effected in the Scottish shale-oil works. There has been in the gas industry a general, shadowy knowledge of the employment of vertical retorts for the distillation of shale; and now what Mr. Herring hopes to prove to his professional friends is that the proper direction in which to look at work on the vertical retort is to the accomplishments of the shale-oil industry, and the proper place at which to start in the development of the system of application in coal-gas manufacture is at the scientific stage at which those retorts and their operation has arrived as the result of nearly 40 years' development. His introductory article appears this week; the second one will be an illustrated description of one of the best types of vertical retorts as at present in use in Scotland; and he proposes, as soon as possible, further articles dealing with the subject from the commercial standpoint, with the view of trying to ascertain in what way the vertical retort can advance the interests of the gas industry. It is evident that Mr. Herring is not enamoured of the retorts so far proposed for coal-gas manufacture; and he describes the type that has been on trial at Mariendorf, and it follows at Dessau, as of "elementary" model.

The Gas Question in Paris.

It will be seen from an article which appears elsewhere that the municipal authorities of Paris left till literally the eleventh hour the settlement of the question—a very important one for the citizens—of the continuance of the gas supply of the city after midnight on Sunday, when the concession of the Gas Company expired; for at two o'clock in the afternoon of that day the report of M. Chautard (the heads of which are given in the article referred to) was awaiting the consideration of the Council at a public sitting. The scheme embodied in the report is essentially a temporary one, and does not contain any pledge or even recommendation in regard to the working of the undertaking. One thing certain about it, however, is that it puts an end irrevocably to sole management by the Company, whose Liquidators will hand over the property to the City authorities on the 31st of December next, at which date it will be open to the Municipal Council to assume the direct control of the service, for which they will have had twelve months' training by means of the arrangement recommended in the report. It appears that no special legislation will be required for this, seeing that on Jan. 1, 1907, the Prefect of the Seine will have entered into possession of the whole of the works and plant; and this action on his part, to which there can be no opposition—inasmuch as it will be the inevitable consequence of the disappearance of the Gas Company—will, it is thought, constitute direct control. M. Chautard considers that events have fully justified the attitude taken by the Council and the several Committees on the question of the gas supply of the city; and he regards the rejection of the various proposals emanating from the Company and others as having been for the ultimate benefit of both the ratepayers and the consumers. When M. Chautard brought up the report, it gave rise to a discussion on certain points; but it was eventually adopted unanimously. The Prefect of the Seine will now set about preparing a scheme for the future management of the undertaking.

The Workless and the Children.

It is not without regret that we have to announce that Mr. Henry Woodall's scheme for doing a part through the gas industry in rendering brighter the lives of a number of the children of poverty has not publicly received the slightest mark of sympathetic approval. We must now confess that from the first the scheme, in its crude form, did not strike us as being workable; but we entertained the hope that it might possibly serve as the rudiment to an effective scheme for good in connection with the industry. Mr. Woodall's proposal was made with a kindliness and generosity that can only make the disappointing result the more bitter. However, he has come to the conclusion that there is no use pursuing his cherished idea further; and he has therefore asked that the subject may be dropped. Under these circumstances, we have returned to Mr. Woodall the cheque for £52 which he sent to start the fund, and which will now go to enrich the treasury of one of the institutions devoted to work among homeless children.

Methods of Charging for Gas.

But little time has been lost by Mr. Alfred E. Forstall in forwarding from the States a letter to the "JOURNAL" with reference to the paper read by Mr. Thomas Newbigging at the November meeting of the Manchester District Institution of Gas Engineers. Our correspondent explains the argument on which his own paper entitled "Methods of Charging for Gas" was based; and he hastens to agree with Mr. Newbigging's sentiment that it is wrong to favour any one consumer, or class of consumers, at the expense of the others. He says that, so far as he can see, the only way in which every consumer can be made to pay his proper share of the expenses and profit, is by making each pay separately for the cost of taking care of his business, as determined by the conditions under which he uses gas, and after that making him pay for the gas used at a price per 1000 cubic feet which will be uniform for all purposes and whatever the size of the consumption. Mr. Forstall concludes his letter by asking Mr. Newbigging a question; and we feel the greatest confidence in asserting that he will not be kept very long waiting for a reply.

"Charred Coal" and Smoke Abatement.

For more than a quarter-of-a-century, Mr. W. D. Scott Moncrieff has been publicly interesting himself in the question of smoke prevention, advocating for the purpose the supply of "charred coal" through the gas-works of the country. We therefore welcome from him a specially contributed article to our columns on the subject; and it comes opportunely in connection with the recent Smoke Abatement Conference. The author has a serious belief in the practicability of his scheme; but we are afraid the bulk of our readers will regard it as purely chimerical. It is, however, a proposal to which the late Sir W. Siemens,

Professor Thompson, and Sir C. Cookson have given support; and in Germany the idea has passed into actuality. The communication is one to which we cannot this week give close attention; and it must not be finally dismissed by a mere passing reference, in view of the thoroughness with which Mr. Scott Moncrieff enters into the matter from his point of view. Charred coal might have an absolutely beneficent effect in relieving the atmosphere of impurity; but from the gas-makers' financial point of view, we fear there are many "holes" to be found in Mr. Scott Moncrieff's "bucket." The London Gas Companies are ever on the look-out for new business; but that the whole of the business in the solid as well as the gaseous fuel required in London should pass through their hands and works is a proposition that would cause them some concern in giving it effect. However, Mr. Scott Moncrieff offers his services if it is thought worth while to appoint a Commission of experts to further consider the question; and on our part we heartily invite a discussion of the proposals and figures advanced. The days of high-power gas have passed into history; but the other figures, although 25 years old, can be readily extended so as to apply to the present conditions.

Efficiency of Coke-Breeze Concrete.

Tests of the fire-resisting qualities of the seven principal forms of cement concrete, recently carried out by the British Fire Prevention Committee, show that excellent results attend the use of coke breeze in this connection; and we are therefore pleased to draw the attention of readers to the investigation. The seven slabs composed of the different materials were placed side by side on the top of a hut, and there, after due preparation, were subjected to a fire-test lasting for three hours, after which two jets of water were directed upon the underside. The slabs were composed respectively of blast-furnace slag, brick, granite, burnt ballast, coke breeze, clinker, and Thames ballast. The details show that in only two cases was the top of the slab without cracks after the test—*i.e.*, in those of coke breeze and burnt ballast; while in the former instance the underside was also quite flat, and only about 1 inch was washed off the surface where struck by water.

Rickmansworth Gas-Works Purchase.

Many columns of the local Press have been occupied during the past few weeks with a discussion on the part of various correspondents of the probable result, so far as the ratepayers are concerned, of the recent acquisition of the undertaking of the Rickmansworth Gas Company. The soundness of the purchase from a financial point of view has been attacked in certain quarters, and as stoutly upheld by the Council's own Clerk, Mr. H. Lomas. Though the works were acquired somewhat more than a year ago, a statement covering twelve months' operations is not yet available. Some sort of a basis for argument has, however, been furnished by Mr. Lomas, who, on request, has provided the members of the Council with details of the exact cost of the undertaking, as well as figures relating to the first six months' working—September to March. It appears from these that the outlay (excluding the parliamentary costs) has been a little under £38,000, which sum has to be wiped off within thirty years. The amount expended in opposing the Company's Act in 1902, and obtaining their own the following year, was roughly £1700; and this has to be repaid within five years. The result is, he shows, that for the next five years the Council will have to pay about £2500 annually in principal and interest, after which the amount will be reduced to £2100. As to the result of the working for the six winter months from September to March last, Mr. Lomas shows that, after deduction of principal and interest, there was a surplus of £12 17s. This is not much; but it is something on the right side. The ratepayers will now probably be anxious to learn from Mr. Lomas whether the summer six months' working has also resulted in a surplus.

The Steam-Roller Again.

The Southampton Corporation have had presented to them some nice little bills in connection with a gas explosion which occurred last May at the Northam Conservative Club; and they decided that they shall pay them (so far as they are found reasonable) without having recourse to the Law Courts. From the very first, that enemy of gas undertakings, the steam-roller, was strongly suspected of being the cause of the catastrophe; and the admission of liability on the part of the Corporation, after obtaining Counsel's opinion, sets at rest any doubt that might have remained on this head. A doubtless most efficacious 13¾-ton steam-roller finds its occupation gone, for the Borough Engineer has been directed to discontinue its employment; while the Gas Company have had their fears for the future allayed by an undertaking on the part of the Corporation "not to use, or cause to be used, any steam-roller in such a way as to fracture, damage, or injure the mains, pipes, or works of the Company properly laid." In addition to this, the Borough Engineer has been instructed to report generally upon the subject of the steam-rollers. The Corporation are to be commended for the reasonable attitude they have taken up in the matter—even though the recognition of the danger that may, and does, arise from the use of enormous weights for repairing road-surfaces has only been arrived at after an accident involving serious injury to life and property.

High-Pressure Distribution.

An appendix to the paper on "High-Pressure Gas Distribution To-Day," which was read by Mr. H. L. Rice, of Aurora, before the American Gaslight Association, shows that there are already a considerable number of places in the United States where gas is transmitted through mains at high pressures. Of transmission installations at pressures of 1 lb. or more, and reinforcing systems, there are ten named. There are thirteen instances of high-pressure transmission lines with low-pressure distribution direct through district governors; and five examples are quoted of the supply of high-pressure gas direct. In addition to all these, particulars are given of several installations which are now in hand or contemplated. By the side of what has been done in this direction in the States, the systems in operation in this country, Germany, and Switzerland do not form a very formidable list.

Injury Caused by Pumping Operations.

In another part of the "JOURNAL" will be found the judgment of Mr. Justice Bray in an action brought by the owner of property at Upton, against the Corporation of Birkenhead, for compensation for "injurious affection" to his land, dwelling-house, and premises, in consequence of the defendants' pumping operations. Under the powers of their Gas and Water Act of 1881, the Corporation had sunk a well about 150 yards from the house, and the pumping of water therefrom had led to settlement. The plaintiff made a claim for damages, to which he submitted he was entitled under section 6 or 12 of the Water-Works Clauses Act, 1847; and the matter was referred to Arbitrators, who could not agree. Eventually the Umpire chosen (Mr. Charles Gott) awarded the plaintiff £1200 and costs. The defendants denied that the plaintiff was entitled to any compensation, either at common law or by virtue of the statutory powers conferred upon them. They contended that section 12 of the General Act only endowed them with authority to take water for construction; and that this was not the purpose for which it was taken. His Lordship thought the question was very much the same as that raised in the Hull gasholder case; and he decided that the plaintiff was entitled to recover the amount awarded, together with the costs of the arbitration, and interest at 4 per cent. on the damages and on the amount at which the costs should be taxed. He also gave him the costs of the action. As leave to appeal was granted, the matter will most probably be heard of again.

Copper Sulphate for Purifying Water.

Reference has already been made in the "JOURNAL" to the experiments of Dr. Moore, of the United States Agricultural Department, with sulphate of copper for purifying water. We learn that this agent has been successfully employed by Dr. J. Howard-Jones, the Medical Officer of Health for Newport (Mon.), on the water in three reservoirs used for the supply of the town. The first one dealt with contained 81 million gallons of water; the second was a small subsiding reservoir containing 9,600,000 gallons of very turbid water; the third contained 78,500,000 gallons. In the second case, the results were so good that the water could be used for drinking purposes; and in the third they are stated to be very satisfactory.

THE NOTIFICATION OF THE GAS REFEREES FOR 1906.

It is two years since the Gas Referees last issued a notification with respect to the testing of the gas supplied by the three Metropolitan Companies. No new issue was made in January last year, because there was then, according to a memorandum circulated by them, nothing of importance to be changed in the previous year's notification; and it was anticipated that changes likely to be made in the London Gas Acts would necessitate the issue of a new notification later in the year. The changes in the provisions of the Gas Acts have come about through the medium of the London Gas Act of last session; but as the Act only entered into operation yesterday, the Referees were able to postpone the issue of a fresh notification until the New Year. The alterations in the prescriptions of the Referees which the latest Act has brought about are of a far-reaching character, as those who have studied the provisions of the measure will realize must of necessity have been the case. The new notification is a document of 52 pages, against 36 for the last issue. It will be useful to indicate the more important changes which have been made, by way of introduction to the extracts which we are able to give elsewhere.

The notification is dated December, 1905, but was issued only in time for delivery on New Year's Day. The table of contents appears as before, but is now followed by a list of illustrations, of which there are twenty. Eleven of these are entirely new; while there are essential departures from the prototypes of two others. The illustration of the "London" argand No. 1 burner, which had appeared almost from the earliest times of the Referees has been expunged, as the sections of the Acts which prescribed that burner have now been superseded. The recital of the Acts under which the Referees' prescriptions are made has been extended by the addition of the London Gas Act, 1905. The Gaslight and Coke Company are now required to provide only fourteen testing-places, against fifteen for the last ten years or so. The testing-place which was formerly located at No. 21, Millbank Street, S.W., is the one which has disappeared. The numbers of testing-places for the South Metropolitan and Commercial Gas Companies remain as before—viz., six and two respectively. The requirement which the Referees made formerly as to the connection of the gas-main with the testing-place by an independent service-pipe, without tap, has been embodied with but little change in the London Gas Act; and a reference to the section concerned of that Act takes the place of the former prescription.

The Harcourt 10-candle pentane lamp remains the standard of light. The testings for illuminating power have, however, now been duplicated. One set is to be made with the "Metropolitan" argand burner No. 2; and it is by these tests only that it will be ascertained whether the gas is of the prescribed statutory illuminating power. It is solely in respect of deficiencies shown thereon that penalties can be imposed. The other set is to be made with a standard flat-flame burner, and it constitutes one of the series of tests which the London Gas Act provides may be made, at such times as the controlling authority shall direct, for the purpose merely of gaining information.

Referring first to the "penalty" testings, the notification quotes the provision of the new Act to the effect that a deficiency of not more than 1 candle on one day in illuminating power shall not in itself render the Company liable to a forfeiture, because the average of the testings for three consecutive days is in that case to be taken as the illuminating power for the intermediate day. The new Act, it will be remembered, requires the Referees to prescribe the burner to be used in the testings; and, in the exercise of this duty, the Referees have prescribed, as already announced in the "Journal," the "Metropolitan" argand burner No. 2, devised by Mr. Carpenter. A detailed drawing of the burner, with the important dimensions marked, is given in an appendix. The burner is to be used in the photometer in the following manner: The damper or disc by which the air supply is controlled is to be kept down—*i.e.*, giving a full air supply—while the gas is burning at about the usual height for about fifteen minutes before each testing; and while the rate of consumption is afterwards being adjusted until it is between 4·92 and 5·08 cubic feet per hour. As soon as the rate has been brought between these limits, the damper is to be screwed upwards—thus checking the air supply—until a sensitive point is reached at which the flame begins to tail up rapidly above the chimney. The damper is then immediately to be screwed back half-a-turn—judged by a pointer attached to it. The observations are afterwards made.

So much for the burner. The photometer is a modification of the Referees' former table photometer. The standard 10-candle lamp remains fixed at a distance of 1 metre from the photoped. The gas-burner, however, is mounted upon a tripod capable of moving upon slides fixed to the table; and the gas connection is made so far as is necessary by means of flexible metallic tubing. A connecting-rod is attached by a plug at one end to the tripod, and at the other end carries a photometric scale, extending from 8 to 17 candles, and divided into tenths of a candle. At this end it is supported by a block, which bears an adjustable index. When the burner is set (by a measuring-rod) at a distance of 1 metre from the photoped, this index is clamped precisely over the division "10" on the scale. Thus, since the 10-candle lamp has been set by means of the same measuring-rod at the distance of 1 metre from the photoped, it follows that, if equality of illumination is obtained when the gas-burner is at the same distance, the gas-flame is giving a light of 10 candles. In practice equality of illumination is to be obtained by pushing the gas-burner to and fro by means of the connecting-rod. The reading on the scale then directly gives the illuminating power. Four readings are to be made; and the mean value corrected to an exact 5 cubic feet per hour rate of consumption under the standard conditions of temperature and pressure. Apart from the arrangements for moving the gas-burner and measuring the illuminating power by its distance from the photoped, and a few minor alterations of screens, the table photometer remains as before. A second tripod and flexible connection, attached to another arm of a three-way tap, is used to carry the burner for the flat-flame testings, which are to be made in the same way as the testings with the argand. The flat-flame burner prescribed for use is Bray's No. 7 (slit) economizer, fitted over a Bray's No. 4 regulator.

The prescriptions in regard to testings for purity have undergone considerable changes since the last issue. In accordance with the provisions of the London Gas Act, the test for sulphuretted hydrogen now extends over only three minutes each day, but is made with wet test-slips. Hitherto the test has extended over about fifteen hours, but has been made with dry test-papers, and at the rate of about $\frac{3}{4}$ cubic foot per hour. The former apparatus has been adapted to the new conditions. The gas now streams up to the top of the bell-jar, instead of impinging directly on the test-slips; and its rate of passage is controlled, by means of a governor-burner on the outlet, to about 5 cubic feet per hour. The apparatus is now detached from the train of purity testing apparatus of which it previously formed an item. Another item of the train—viz., the ammonia test—has now disappeared altogether; and the Referees make no prescription as to the amount of ammonia which the gas may contain. The test for sulphur compounds other than sulphuretted hydrogen remains with little change, but is now to be carried out for information only on such days as the controlling authority shall direct. The chief alteration is the abolition of the recording aerorthometer and stop-clock in connection with this test.

Then comes an important innovation—the prescription as to the mode of testing the calorific power of the gas. This is another of the "information" testings which the London Gas Act empowers the controlling authority to make at such times as it directs. The calorimeter prescribed for use in these testings is that devised by Professor C. V. Boys, of which a description was given in the "Journal" for Dec. 19, p. 808. The mode of testing with it is described in detail—a routine it would be difficult to follow without reference to the instrument being set out, and a form for calculating and recording the results being given.

The mode of testing the pressure at which gas is supplied remains unchanged. An example of a form for returning the results of all the testings is provided. No prescriptions are now made by the Referees as to the amount of impurity in any form with which the gas shall be allowed to be charged. The provisions of the London Gas Act, it will be remembered, deprived them of their former power to prescribe a limit to the amount of sulphur in the gas. In regard to minor points dealt with in certain of the fourteen appendices to the notification, there are small changes in the arrangements for the provision and testing of pentane for use in the testing-places, and the aerorthometer is now illustrated and fully described. There is a new appendix, dealing with the provision by the Referees of loan apparatus to replace defective pieces of apparatus at testing-places while they are sent away for repair or are being exchanged for new. The object of the provision is to make the suspension of any of the operations of gas testing, from defects in the apparatus, as short as possible.

The price of the notification remains unaltered (at 1s. 6d.), notwithstanding its greater bulk.

Midland Junior Gas Engineering Association.—We learn from the Hon. Secretary and Treasurer of the Association that a general meeting of the members will be held at the Birmingham Technical School next Saturday, when Mr. S. T. Smith will read a paper on "Some Types of Stoking Machinery for Horizontal Retorts."

A New Coalfield in Colorado.—A new coalfield which is expected to prove of considerable importance has lately been studied by members of the United States Geological Survey. In a remote geological age, thick sheets of lava were forced into the coal formations of Routt County (Col.), and beds of coal within 50 to 75 feet of such sheets were changed to anthracite or semi-anthracite. The cretaceous coals examined were distributed through a vertical thickness of 1000 to 2000 feet of strata, chiefly sandstone and shales. It was quite impossible to determine the extent to which the lava beds had influenced these coal seams, because the surface is densely wooded, and outcrops of rock and coal are very few. Anthracite coal is known to occur in patches on an area of at least 50 square miles; and there are probably more than 500 square miles affording more than 10 feet of workable coal. Up to the present time, only a few tunnels have been driven more than 100 feet for coal for domestic use only. It is expected, however, that with the coming of the Denver and North-Western Railway the importance of this field will receive full recognition.

ELECTRIC LIGHTING MEMORANDA.

A Review of the Past Year.

LOOKING backward is not always an unprofitable occupation. Events sometimes escape memory that it is useful to have revived; and a general survey of the past frequently assists in energizing one's actions in the future. Glancing over the past year at matters electrical, so far as they in any way affect the gas industry, considerable satisfaction is to be derived by all concerned in the latter. The year is marked with incident, and that and the present position are such as to inspire great confidence in the future. Recognizing that in the competition between gas and electricity the position of the former has been vastly strengthened, and that this has been brought about by untiring and potent work on the part of those engaged in the industry, aided by excellent weapons of offence and defence—the means having been found so effectual, must continue to be exercised no less forcibly in the future than in the past. And not only by direct competition for business is contact made by the gas industry with the electrical. Electricity is so largely a municipal concern, and is so commonly conducted on fatuous and pernicious lines, for the purpose of showing a fictitious condition of affairs in respect of financial improvement, that gas undertakings, in common with other ratepayers, suffer seriously from the baneful effect.

This is a suitable starting-point for the review. The year has been fruitful in illustration of the irregular ways of the municipal management of a great many electricity supply undertakings; and those irregular ways can be traced to the financial licentiousness that takes possession of members of municipalities directly they resolve to enter into this branch of trading, and to imperil the ratepayers' money. So great have become the financial straits in numerous instances that all sorts of juggling in the matter of accountancy is now resorted to in order to hide the fact of financial instability. To such an extent have the ratepayers been imposed upon that that arch municipalizer, Mr. John Burns, in his capacity of President of the Local Government Board, is appointing a Committee to look into this question; and we hope it will have some good effect in assisting to purify local government, and in helping to suppress unfairness in competition. In the inquiry, Battersea must not be missed. The Inspectors of the Board have during the year been very busy unearthing some of the sordid actions of those directing municipal electricity ventures; and certain corporations of influential cities and towns whose actions ought to be above suspicion have been found guilty of a looseness and shadiness in financial management, and indifference to the authority of the Local Government Board, that one would not have expected to find even on the part of unlettered members of the governing authority of an insignificant rural district. Manchester, Oldham, Brighton, Bermondsey, and Walthamstow are sufficient examples. Such a serious condition of affairs has indeed been exposed at Brighton that the Local Government Board have deferred giving their sanction to the last loan for which application has been made. Prodigality in capital expenditure, outlay largely in excess of estimates and authorized loans, deferred repayments of loans, and wilful disregard for the future, under-assessments for rating purposes, the diversion of charges from the electricity accounts to the general rates, the subsidizing of undertakings from the rates and through the public lighting—these are of the lines along which we have again and again in the course of the year exposed failure in duty by the custodians of the local purse and administrators of important public trusts.

But, notwithstanding all the studied endeavour to conceal by stealth the true state of financial affairs, it was remarkable what a large number of municipal concerns again exhibited deficits on their working, and more remarkable still the number who showed reduced—and some largely reduced—profit-balances, compared with the previous year, after pruning down the charges or transferring parts to other accounts. This reduction of the so-called profit-balances is a thing that must go on while municipalities are allowed to continue to ignore correct financial principles. Capital expenditure cannot proceed with impunity while debts upon plant and appliances remain undischarged at the end of their serviceable life; nor can insufficient repayment of loans be persisted in, without, in the strongest of undertakings, eventually reducing profit-balances, and bringing such concerns to the verge of, if not actually to, financial disaster. The past year has thrown much illuminating evidence on the side of this view. There are few municipal electrical undertakings that showed in the last accounts published any conspicuous gain in the making of profit; but the much-troubled Dublin venture—so it was printed big in the local Press—did "turn the corner." This turning of the corner came conveniently in advance of an application for another loan of a round £100,000—conveniently, because the Local Government Board for Ireland on the occasion of the previous application did not appear to entertain a very high opinion of the manner in which the ratepayers were being dealt with in connection with this over-capitalized municipal undertaking. It has also become, by the experiences of the year, more and more obvious that residential districts where industrial and business establishments do not abound are not the best for the exploitation of electricity supply. The Local Government Board have been aroused to a sense of their responsibility in defending communities against their too-ardent and ill-advised (in this matter) representatives. The year has, in consequence, witnessed the refusal of loans in certain cases, owing mainly to the view of the Board that indulgence in electricity supply will bring a burden upon the ratepayers. The Board have also taken other steps to bring about a healthier condition of affairs—for example, by reducing the loan periods for perishable plant, and by issuing a notification which will end the trade in Electric Lighting Orders, and will compel the transfer of privately obtained Orders to registered companies within a definite period or the certain abrogation of the Orders, instead of allowing them to be held as marketable property for an indefinite period. So great is the financial unsoundness in certain cases, that proposals have been seriously made during the year for the sale of undertakings—Southwark, Tunbridge Wells, and Worcester have been noted. There is no doubt that among the smaller communities, encouraged by the Local Government Board, there is a growing tendency to purchase electricity in bulk for distribution, in preference to putting up a special generating-station for the purpose.

There are two of the charges of malpractice by local authorities in the conduct of their electricity businesses to which we may further direct attention. They have reference to the under-assessment of the works and plant, in a manner totally unfair to the general body of ratepayers and competing interests, and to the subject of works depreciation. As to the first, we commented freely on the matter recently, taking Poplar as an illustration; and since then there have been published the revised assessments under the quinquennial valuation of several of the generating-stations and the distribution systems, of those Metropolitan boroughs in which the municipal authorities are the undertakers; and these conclusively prove the accusation of under-assessment. The rateable values in question now appear as follows: Bermondsey, £1796; Fulham, £2432; Hackney, £3430; Hammersmith, £6500; Hampstead, £13,000; Islington, £4666; Poplar, £3760; St. Pancras, £6621; Shoreditch, £4628; Stepney, £4233; Woolwich, £2620. A comparison of the capital expenditure of the concerns named with the rateable values given here, show the absurdity of the amounts. In Paddington, the assessment of the Metropolitan Electric Supply Company's works has been increased by £11,970; and the Borough Council have resolved to approach the London County Council with the view of that body taking action to have the assessments of the municipally owned undertakings brought up to their real values. We hope that they will succeed. That a correct financial policy includes due attention to depreciation has been manifested on more than one occasion during the year. In connection with the concerns of the London Borough Councils, several references have been made. At Sheffield it was shown some months since that, with a heavy capital expenditure, the Electricity Department have in hand no reserves other than some £20,000 surplus; and at Brighton, the recent inquiry disclosed an extraordinary lack of common prudence in making provision for the replacement of obsolete plant on which the capital debt had not been extinguished. These are only two instances out of many. The Local Government Board have not overlooked the matter; and, as mentioned earlier, they have, in consequence of this lack of forethought, reduced the period for the repayment of loans. There was also an instance—the Accrington Bill—during last session of the Police and Sanitary Committee of the House of Commons, reducing the period for the repayment of loans for electrical equipment to twenty years, and for electrical fittings to ten years—the Chairman remarking that, from his experience of the life of such things, even these periods were all too long.

Leakages of the ratepayers' money with the only object of giving support to municipal undertakings, have continued to be brought about by an extravagant adoption of electric lighting in the case of public buildings, when it has been shown beyond dispute that economy and efficiency are on the side of incandescent gas lighting. It is, however, in regard to street lighting that the fiercest controversy has raged. Complaint of the greatly increased cost of public lighting following upon the adoption of electric lighting has been rife from north to south and from east to west. To indicate the accuracy of the statement, we instance the City, Preston, Croydon, Canterbury, Chester, Bermondsey, Poplar, Hastings, Newcastle, Bath, Bury St. Edmunds, and Monmouth. The only and wonderful remedy that the electricians can find is a close trimming down all round. The supply of current at below cost, late lighting up and early extinguishing, and a wider spacing of the arc lamps. These are the puny methods by which economy is sought. Others try to prove a superiority in point of cost by pounding down the expenses to per candle-power hour, or to per candle-power per annum, but refuse to quote for efficient lighting on a basis understandable by "the man in the street." A perfect *furore* was created in electrical circles by the decision of the City Corporation to displace about one-tenth of the electric arcs by high-pressure incandescent gas-lamps and duplex-burner lamps at ordinary pressure. The City has been paying £26 per annum per arc lamp; but directly the change took place electricians—irresponsible so far as the City is concerned—were free with their estimates of what they would be prepared to do the lighting for, if (what a really perfect safeguard!) they did not labour under the disadvantage of not being the authorized suppliers of electricity in the City. We need not to-day traverse the whole of the ground again. The wherefore of the change, and

the improvement that it has effected in respect of both economy and efficiency, have been fully set forth; but it is noticeable that, up to the present, there is no information to hand as to the City Electric Light Company having made any offer to reduce their charges for the 450 or so lamps still supplied by them to the estimates—about half the price now paid them, and dear at that—which are suggested as fair by correspondents in the electrical press. It is, however, remarked that the Company who have competitors in the Charing Cross Company have since entered into an arrangement with the latter by which the cutting policy in respect of private business will forthwith cease. It was bound to come, and Parliament and all who assisted the Charing Cross Company into the City have the knowledge now of how nicely they have been sold. If Parliament had only foreseen the possible repetition of history in this case, what then?

We are, however, on the question of public lighting. Kingsway and Aldwych—the newest of London thoroughfares—are lighted by high-pressure gas-lamps; and Waterloo Bridge has returned to gas. Notable captures for gas have also been the new Victoria Station of the London, Brighton, and South Coast Railway, and Broad Street Station. Outside Buckingham Palace, too, there is nightly to be seen a flood of rich light from high-pressure gas-lamps. At Croydon, Malton, and Sutton there have been small successes for electric lighting; but from the two latter places we hear of grumbling over the ineffectiveness of the electric lamps. Much has been made in the controversy as to the continuation of a contract for street lighting with the St. James and Pall Mall Company by the Westminster City Council; but already complaint has been made by the Council that the lamps are under the agreed standard illumination. The contract penalty is to be enforced. Will Croydon please note this? Warnings by the Local Government Board to local authorities as to the costliness and inefficiency of electric lighting for street purposes have been frequent. It has been very gratifying to see how electricians during the year have been condemning the old arc and other types of electric lamps as illuminating agents in the depth of foggy weather and for securing uniformity in illumination. One reason for this is found in their preference for some particular form of new lamp—generally, of the flame arc kind. We have since had foggy days in London; and the flame arc lamps have given no better account of themselves than the old and ordinary type of lamps. On clear nights, the police do not like the lamps on account of the fearful localized glare; and the verdict is that they are no better for efficient street lighting than the common form of arc. As we have said before, we say again, they are showing, and are accentuating, in their performance all the defects of the old lamps. All that can be claimed for them is that their local brilliance is greater. Connected with this subject, the deficiency of the education of electrical engineers in the science and art of photometry was made clear during the year; and, among others, we had some humorous readings presented by Mr. Frank Bailey of the City of London Company, which readings have not been withdrawn, although the figures themselves show that—purposely or in error—they are positively inaccurate and misleading.

Turning to other forms of lighting, the new lamps—the Nernst, the Tantalum, and the Osmium—have not served the electrical industry well; and the search still goes on for the reliable lamp that will produce a greater amount of light for the expenditure of less energy. It is an exigent requirement; but it seems as far off as ever. The lamps named above do give a greater amount of light for the expenditure of less energy; but they are not reliable. They have all their own peculiarities. The Nernst lamp is a failure on account of its want of uniformity; it was evicted from Big Ben in order to economize; it must have constancy of pressure, to ensure constancy in behaviour; and electrical engineers generally report against it after trying it in their street lamps. The Tantalum lamp will not act on continuous current systems; and its filaments are constantly breaking, and with breakages, although they have a knack of restoring connection, the illuminating power decreases. In Osmium lamps, the filaments are brittle, and the lamps must be run in series and in a definite manner. All these lamps are dear in first cost; and the results in illuminating power and life of laboratory experiments with them are not obtained in practice. Though energy is saved, the running cost, at low rates for current, is considerably more than for ordinary incandescent gas lighting. During the year we have had Professor Davidge before the Junior Institution of Engineers and Mr. Leon Gaster in "The Times," speaking of the little progress that has been made in electric lamps of the lower powers; and members of the Municipal Electrical Association have raised their voices complainingly in regard to the want of uniformity in the performance of such productions as there are. Mr. James Swinburne, too, has honestly admitted the greater cheapness of incandescent gas-burners on the light basis compared with electric lamps. Relative costs have been a matter of spirited controversy—figures from the gas industry; words from the electrical industry, of which the favourite but unsupported one has been "absurd," applied to the gas figures. The answer to that now is, "Ask Mr. Swinburne." Where electric lighting for private purposes is preferred, information published on Aug. 1 showed that a gas-engine can give the electric current at cheaper rates than is commonly charged by town suppliers. Prepayment meters for electricity do not appear to be making much headway. A correspondent in an electrical contemporary has just written as follows on the subject: "A good, reliable prepayment meter would be a great help. The alternating current ones give disappointing results; the switching mechanism being very erratic, and the methods used for sealing the cases being open to adverse criticism. Besides, the general design of the instruments is not conducive to long life; so that they cannot be considered, with their extra cost, as warranted to prove good investments." Beyond this, the working man cannot afford to patronize a dear light.

The great event of the year has been the Electrical Exhibition at Olympia; and the electricians, of course, regard it as having been very successful. An effort was made there to give a little impetus to cooking and heating by electricity; but on all sides the ways are barred. As to the appliances, first cost and the cost of repairs are not favourable; and their efficiency is poor, and the expense great even at 1d. per unit. Renewed effort was made to get business by offering further inducements to consumers, and by "free" wiring. The London County Council made a fresh attempt to procure powers for the Borough Councils to carry out business of this kind; but there was strong opposition by the Electrical Contractors' Association and the London Gas Companies. In the Commons, a clause was inserted in the Bill ensuring that such business should be self-supporting; in the Lords, the Duke of Northumberland (whose title gives name to a clause that is despised by municipalities) and certain other of his noble colleagues refused the powers. The County Council are going to make a further attempt this year; and there will be another fierce contest. All over the country the Electrical Contractors' Association are bringing municipalities to book who are exceeding their powers in this regard; and it looks as though there is to be litigation with the Sheffield Corporation over the matter. In Parliament, the prominent event of the year was the tremendous struggle over the London Power Bills; resulting in the passing of the Metropolitan Electric Power Company's measure, and the loss by the Administrative Company of their measure through insufficient time. This Bill, one by the County Council, and others for bringing to London electricity from a distance will, if they are not stopped by the appointment of a Commission to inquire into the general question, engage the attention of Parliament next session. The story of all these Bills is too large for brief reference here. The Northumberland clause during last session found place in several Electric Lighting Orders; but where there was contention over its insertion, there was not uniform success. But on the whole the result was gratifying. Protection against electrolysis did not gain much ground; but to this subject, a reference appears in our leader columns.

The report of the Chief Inspector of Factories and Workshops unfortunately showed a considerable number of fatal and non-fatal accidents in electricity works. Regarding explosions in street boxes, further evidence was obtained as to the generation of gas from the bitumen coverings of electric cables. The Gaslight and Coke Company had to pay damages for the results of an explosion of gas in telephone street chambers, which an intelligent care on the part of the Post Office telephone men might, it is obvious, have averted. After a keenly contested struggle in the Law Courts, the Manchester Corporation conclusively had their distribution system, through its fire-generating propensity, branded a nuisance; and sufferers obtained damages. The Borough Council of St. Pancras have just lately been the recipients of a writ in respect of nuisance alleged to be occasioned by their electricity works. Several fires have during the year been caused by electric installations; and electric lamps have had their innocence greatly damaged in respect of fire-raising when brought into contact with combustible material. The review of the electrical affairs of the year is certainly not an uninteresting one for the gas industry.

Application of the Incandescent Mantle to Gas Analysis.

At a recent meeting of the Chemical Society, a note "On the Incandescent Mantle as a Catalyst and its Application to Gas Analysis" was presented by Messrs J. E. Mason and J. Wilson. The method described by Professor Lewes for demonstrating the incandescence of the ordinary gas-mantle in a cold mixture of coal gas and air may also be employed with a mixture of ammonia vapour and air. The authors described a modification for showing the incandescence of the mantle in an unburnt mixture of alcohol vapour and air. Though less effective, the mantle may be used as a substitute for platinized asbestos in the ordinary lecture experiments for preparing formaldehyde from methyl alcohol vapour and air, and sulphur trioxide from sulphur dioxide and oxygen. Fragments of mantle in a hard glass (or preferably a quartz) tube, may be used in place of palladium or palladium-asbestos, for the estimation of hydrogen and carbon monoxide in gas analysis by combustion with excess of air or oxygen. Methane and mixtures of methane and hydrogen may be estimated similarly by passing these gases mixed with excess of oxygen over fragments of mantles heated in a quartz tube, and measuring the contraction after combustion and subsequent treatment with caustic potash solution. The results agree well with those obtained by the customary explosion methods. Good results may also be obtained by passing the gases mixed with oxygen over asbestos heated in a small quartz tube. Hydrogen, and less readily methane, may be estimated by passing the gas mixed with oxygen through narrow tubes of heated Jena glass.

THE IRON AND STEEL TRADES IN 1905.

THE existing position of the iron and steel trades shows a very great improvement over that of twelve months ago; and therefore on the present occasion the annual report of Messrs. Bolling and Lowe cannot but afford pleasant reading to those who are engaged in these industries. It may be called to mind that 1904 was not a good year; but the period now under review has been one of increased production and rising prices. Great strength is reported in the trades of the Midlands and the North; considerable impetus having been given to them by the growing demands of shipbuilders and the requirements of the bridge building and structural industries. In the early autumn, these demands became so pressing that prices rapidly advanced; and a similar happy condition of affairs prevailed on the Continent. As to the outlook for the coming year, in view of the favourable reports from the Colonies and our other best customers, Messrs. Bolling and Lowe regard this as most promising, unless political troubles supervene. Trade shows every sign of expansion; and there are also the extensive shipbuilding programmes of Russia and Japan to be taken into account—to say nothing of the rumour that China is prepared to expend £20,000,000 on a new fleet. It is to be noted that the increase in British steel output for 1905—estimated at 1,000,000 tons—is largely due to decreased imports; while, at the same time, exports here and there increased considerably.

Much of the rise that has taken place in the price of pig iron has, it is stated in the report, been due to speculation; but the chief demand came from the abnormal requirements of the iron and steel industries. The estimated production for 1905, in the three principal countries, shows a very large increase over that for the previous year. The figures are, in round numbers, as follows: Great Britain: 1905, 9½ million tons; 1904, 8½ million tons; increase, 1 million tons. United States: 1905, 23 million tons; 1904, 16½ million tons; increase, 6½ million tons. Germany: 1905, 10½ million tons; 1904, 10 million tons; increase, ½ million tons. In September, 1904, there were in this country 324 blast-furnaces working; but by the end of the past year the number had increased to 348. The value of the iron and steel exported during the eleven months ending Nov. 30 of the three last years is reported to have been: 1905, £29,561,408; 1904, £25,911,557; 1903, £28,573,405.

With regard to rails, it is stated that the European works have been fully employed; while the United States mills have lately been unable to cope with their home demand, and consequently their exports are not large. The output of Great Britain is estimated at 900,000 tons; that of Germany at 1,100,000 tons; and that of the United States at 3,000,000 tons. As stated in the previous year's report, the makers in Great Britain, Germany, Belgium, and France agreed to pool their export orders for rails; and during 1905 the Syndicate have maintained figures at a high level—difficulty having lately been experienced in getting delivery, especially for lighter sections. Great Britain's exports for the first half of the year show an increase of 1000 tons over the corresponding period of 1904; and as in that period British makers exceeded their allotted quantity, they have now to allow the Continental firms to complete their average.

AN ADMISSION OF MUNICIPAL FAILURE.

OF all the melancholy confessions of blighted hopes and unrealized expectations which have fallen of late from the advocates of municipal trading, that which was made a fortnight ago by the Chairman of the Torquay Electric Lighting Committee is the most dismal. The Torquay Corporation have been engaged in the electric lighting business for seven years. In the number of lamp-connections, it is a business which has shown steady progress. There are probably quite as many customers as could be expected, having regard to the population within the area of supply and to the price charged for current. The undertaking has had all the advantage of municipal patronage and advertisement, with the result that electricity has been introduced into the public offices and is extensively used for the lighting of the streets. Perhaps the last is hardly an advantage; for, according to the Local Government Board's calculation, though the public lighting is costing the ratepayers considerably more than it used to do, it is being carried out at a loss to the Electricity Department. Still, whether profitable or not, the electricity works have all the business which the Corporation can put in their way, and have been trading for seven years in a district highly favoured in the large proportion which it has of well-to-do residents and of good hotels and boarding-houses, to whom the electric light is not an unattainable luxury. Yet, with all this in its favour, the undertaking is financially a pronounced failure.

In six-and-a-half years, it has made a profit of £424; and it is anticipated that for 1905 there would be a credit balance of £1244. With these figures before them, some members of the Council have seen visions and dreamed dreams. One of them spoke of the electricity works as "the one municipal asset to which they were looking for a decrease in the rates." This is the natural expectation of supporters of municipal enterprises. They are all to reduce the rates—some day. In the case of Torquay, the realization of the hope appears likely to be very remote; for when the expected profit of £1244 is submitted to analysis, it rapidly disappears. First of all there has to be deducted from it £253 in order to give certain consumers a promised reduction. Then there is £780 to be taken for interest and sinking fund on £8000, which is to be spent on additional plant to enable the Corporation to supply current for the tramways. The net result is that the profit will be reduced to about £210; and, as the capital outlay will shortly have reached the sum of £50,000, the profit cannot be considered, even by the most ardent friend of municipalization, as adequate. Nor is there very much encouragement to be derived from any attempt to forecast the future. The Chairman of the Electric Lighting Committee has been attempting to do this, and is driven to the melancholy conclusion that "the prospect did not look particularly bright." He has to admit that there is faint hope of a substantial extension of the business—its immediate tendency being to shed its big customers—while the prospect of making a profit out of the sale of current to the Tramway Company is now conceded to be a vain delusion. When there is added to this the probability of further expenditure on the works in a few years' time, and the certainty that the present rate of depreciation is quite inadequate, the Chairman's melancholy view of the outlook is not difficult to understand.

The immediate question before the Town Council at the meeting referred to was a proposition to sell or lease the works to a company. Holding the opinion already indicated, that the prospect is discouraging, the Chairman of the Committee was in favour of the Corporation ridding themselves of responsibility, and allowing a company to see whether they could not carry on the business with more hope of success. He gave away the whole case of the municipalizers in the confession that "a company properly managed and thoroughly understanding their business would make a profit where a corporation made a loss." This he explained as being due to the fact that the company could make economies impossible to the corporation; and that they had control of larger capital, and were not hampered to the same extent by Government restrictions. The whole advantage of the company may, however, be summed up in the one phrase, that they understand their business, and the corporation do not. A majority of the Torquay Corporation is nevertheless not prepared to see the undertaking pass from under their control. By one vote—15 to 14—they decided not to entertain an offer to purchase "for the present." Perhaps when time has verified the Chairman's prognostications, they may be prepared to listen; but for the time being they will go on hugging the hope that something will come of it. The substantial reason suggested for the continuance of the works under the management of the Corporation was that if it is worth a company's while to buy the concern, it was worth the Council's while to keep it. It was also argued with equal force that the undertaking has not cost the ratepayers a penny; and that, as they are not losers by it, the ratepayers might as well keep it. Both these points would be worth analysis if it were possible to get at the true inwardness of the business. It is at least certain that the ratepayers have made nothing out of it. What it may have cost them indirectly—in greater outlay on public lighting, and in a dozen more or less invisible ways—is quite another matter.

THE GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 49.)

THE brief space intervening between the reopening of the Stock Exchange after the Christmas holidays, and the close of the year, was mainly devoted to the settlement of the last fortnightly account, which was a heavy one, but which has apparently involved no difficulties that were insuperable. The tendency was full of fluctuations—up one day and down the next; Russian affairs and the money outlook being the controlling factors. In the end, the brighter view prevailed; so that even Friday and Saturday were quite cheerful, and the course of prices was upward. In the Money Market there was a strong demand, which only eased off at the close. Discount followed in a similar line. Business in the Gas Market was upon a much reduced scale, but prices showed no weakness for lack of support. On the contrary, a very large number of quotations improved on their figures; while only one receded. In Gaslight and Coke issues, the ordinary was quiet but firm, with some promise of improving; and prices ranged from 102¼ to 103, which last was the closing figure of the year. In the secured issues, the maximum marked from 89½ to 90½, and the preference, 111½; but the debenture was not dealt in. South Metropolitan was very quiet and steady; all dealings being marked at 132¼ and 133. The debenture changed hands at 88½. In Commercials, only the 4 per cent. was dealt in; prices being marked 117½ and 118. Among the Suburban and Provincial group, Alliance and Dublin were lower; but several others advanced—*e.g.*, Brightons, Bromleys, and Hastings. Bournemouth "B" marked 17½ and 17⅞, and British 43½; but no other was dealt in. The Continental Companies were very quiet. Imperial was done four times at 234; and ditto debenture marked 97. Union changed hands at 128¾; and European, at 22¾. Among the undertakings of the remoter world, Buenos-Ayres debenture realized 95⅝, Primtiva ordinary 7⅛, ditto preference 5¼ and 5 5/16, and ditto debenture 98 and 98¼, River Plate

$13\frac{1}{16}$ and $13\frac{3}{16}$, and Monte Video 12. Cape Town was done at $17\frac{7}{16}$.

According to usual custom, we append a table showing the closing prices at the end of 1904 and those of 1905, with the respective gains and losses in value. On the whole, the variations have been of less than ordinary magnitude. The Metropolitan Companies have hardly moved. Some of the Suburban and Provincial Companies have advanced materially, especially Liverpool and Brentford. The most conspicuous gains are in the Continental group, where improved prospects effected a marked recovery in Continental Union, and a bonus of capital enhanced the value of Imperial. Taken generally, the gas industry appears to be in a decidedly healthy state, and may look forward to the chances of 1906 with pleasurable anticipation.

GAS COMPANIES.	Prices on Dec. 31, 1904.	Prices on Dec 30, 1905.	Gain or Loss.
Alliance and Dublin, 10 per cent.	ex$\frac{1}{2}$—21$\frac{1}{2}$	20—21	—$\frac{1}{2}$
Do. 7 per cent.	14—15	14$\frac{1}{2}$—15$\frac{1}{2}$	+$\frac{1}{2}$
Bombay, Limited	6—6$\frac{1}{2}$	6$\frac{3}{4}$—7$\frac{1}{4}$	+$\frac{3}{4}$
Do. New, £4 paid	4$\frac{1}{2}$—5	5—5$\frac{1}{2}$	+$\frac{1}{2}$
Bournemouth, 10 per cent.	.. ..	29—30	—
Do. B. 7 per cent.	.. ..	17—18	—
Do. Preference 6 per cent.	.. ..	15$\frac{1}{2}$—16$\frac{1}{2}$	—
Brentford, Consolidated	250—255	260—265	+10
Do. New	190—195	197—202	+7
Do. 5 per cent. Preference	130—135	125—130	—5
Do. 4 per cent. Debenture Stock	105—1 8	101—104	—4
Brighton and Hove, Original	227—232	222—227	—5
Do. A Ordinary Stock.	167—172	162—167	—5
British	40$\frac{1}{2}$—41$\frac{1}{2}$	42$\frac{1}{2}$—43$\frac{1}{2}$	+2
Bromley, Ordinary 5 per cent. A.	117—122	121—124	+3
Do. 3$\frac{1}{2}$ per cent. B.	92—96	91—94	—1$\frac{1}{2}$
Buenos Ayres (New), Limited	11$\frac{1}{4}$—11$\frac{3}{4}$	12$\frac{1}{4}$—12$\frac{3}{4}$	+1
Do. 4 per cent. Debenture	93—95	95—97	+2
Cagliari, Limited	24—26	24—26	—
Cape Town and District, Limited	15$\frac{1}{2}$—16	17—17$\frac{1}{2}$	+1$\frac{1}{2}$
Do. 4$\frac{1}{2}$ per cent. Preference	9$\frac{1}{2}$—9$\frac{3}{4}$	10—10$\frac{1}{2}$	+$\frac{3}{4}$
Do. 6 per cent. 1st Mort.	51—53	52—54	+1
Do. 4$\frac{1}{2}$ per cent. Deb. Stock	102—102	100—102	—
Commercial, 4 per cent. Stock	117—120	116—118	—1$\frac{1}{2}$
Do. 3$\frac{1}{2}$ per cent. do.	113—116	112—114	—1$\frac{1}{2}$
Do. 3 per cent. Debenture Stock.	85—87	84—86	—1
Continental Union, Limited	114—117	126—129	+12
Do. 7 per cent. Preference.	140—145	143—145	+3
Derby, Consolidated Stock	.. ..	125—127	--
,, Debenture Stock	.. ..	108—110	—
European, Limited	20$\frac{1}{2}$—21$\frac{1}{2}$	22—23	+1$\frac{1}{2}$
Do. £7 10s. paid	14—15	15—16	+1
Gaslight and Coke, 4 per cent. Ordinary	103—104	102—103	—1
Do. 3$\frac{1}{2}$ per cent. maximum	92—94	89—91	—3
Do. 4 per cent. Con. Pref.	109—111	110—112	+1
Do. 3 per cent. Con. Deb.	86—88	86—88	—
Hastings and St. Leonards, 3$\frac{1}{2}$ per cent.	100—103	101—103	+$\frac{1}{2}$
Hong Kong and China, Limited	16—17	19$\frac{1}{2}$—20$\frac{1}{2}$	+3$\frac{1}{2}$
Imperial Continental	210—212	233—235	+23
Do. 3$\frac{1}{2}$ per cent. Deb. Red.	96—98	96—98	—
Lea Bridge Ordinary, 5 per cent.	118—123	123—128	+5
Liverpool United A	219—221	237—239	+18
Do. B	160—162	172—174	+12
Do. Deb. Stock	106—108	109—111	+3
Malta and Mediterranean, Limited	4—4$\frac{1}{2}$	4$\frac{1}{4}$—4$\frac{3}{4}$	+$\frac{1}{4}$
Metropolitan of Melbourne, 5 p. c. Deb.	102—104	100—102	—2
Do. Do. 4$\frac{1}{2}$ p. c. Deb.	100—102	100—102	—
Monte Video, Limited	10—11	11$\frac{1}{2}$—12$\frac{1}{2}$	+1$\frac{1}{2}$
Newcastle and Gateshead, Consolidated	109—110	107—109	—1$\frac{1}{2}$
Do. 3$\frac{1}{2}$ p. c. Deb. Stk.	90—91	98—100	+8$\frac{1}{2}$
North Middlesex, 10 per cent.	.. ..	18$\frac{1}{2}$—19$\frac{1}{2}$	—
Do. 7 per cent.	.. ..	13—14	—
Oriental, Limited	147—150	148—151	+1
Ottoman, Limited	5$\frac{1}{2}$—6$\frac{1}{2}$	6—6$\frac{1}{2}$	+$\frac{1}{4}$
Primitiva, Ordinary	5$\frac{1}{4}$—5$\frac{3}{4}$	7—7$\frac{1}{2}$	+1$\frac{3}{4}$
Do. 5 per cent. Preference	4$\frac{3}{4}$—5$\frac{1}{4}$	5$\frac{1}{8}$—5$\frac{3}{8}$	+$\frac{1}{4}$
Do. 4 per cent. Deb. Stock	93—95	97—99	+4
River Plate, Ordinary	11$\frac{3}{4}$—12$\frac{1}{4}$	12$\frac{3}{4}$—13$\frac{1}{4}$	+1
Do. 4 per cent. Deb. Stock.	94—96	95—97	+1
San Paulo, Limited	12—12$\frac{1}{2}$	13—13$\frac{1}{2}$	+1
Do. 5 per cent. Deb. Stock.	53—55	51—53	—2
Sheffield, A.	238—240	244—246	+6
Do. B.	237—237	244—246	+7
Do. C.	236—238	244—246	+8
Shrewsbury, Ordinary, 5 per cent.	104$\frac{1}{2}$—107$\frac{1}{2}$	110—120	+9
South African	16—17	15$\frac{1}{2}$—16$\frac{1}{2}$	—$\frac{1}{2}$
South Metropolitan, 4 per cent., Ordinary	132—134	132—134	—
Do. 3 per cent., Deb. Stk.	89—91	87—89	—2
South Suburban, Ordinary 5 per cent. Stk.	123—126	123—126	—
Do. 5 per cent. Preference Stk.	125—130	125—130	—
Do. 5 per cent. Debenture Stk.	133—138	132—137	—1
Southampton, Ordinary	105—107	109—112	+4$\frac{1}{2}$
Tottenham and Edmonton, A 5 per cent.	123—128	125—128	+1
Do. B 3$\frac{1}{2}$ per cent.	95—100	99—102	+3
Do. 4 p.c. Deb. Stk.	102—105	105—107	+2$\frac{1}{2}$
Tuscan, Limited	8$\frac{3}{4}$—9$\frac{1}{4}$	9$\frac{1}{2}$—10	+$\frac{3}{4}$
Do. 5 per cent. Deb. Red.	96—98	100—102	+4
Wandsworth and Putney, A 5 per cent.	.. ..	.. ..	—
Do. B 3$\frac{1}{2}$ per cent.	.. ..	137—140	—
Do. C 3$\frac{1}{2}$ per cent.	.. ..	113—116	—
Do. 3 p. c. Deb. Stk.	.. ..	80—83	—
West Ham, 5 per cent. Ordinary	100—102	106—108	+6
Do. 5 per cent Preference	122—127	123—126	—
Do. 4 per cent. Debenture Stock	101—106	102—107	+1

The Lewes Self-Carburetting Patent Void in Germany.

It is announced that the Imperial Final Court of Appeal in Germany pronounced judgment on the 9th ult. in the action brought by the firm of Julius Pintsch, of Berlin, against the Dellwik-Fleischer Water Gas Syndicate who exploit the process, covered by the German patent No. 130,112, of Professor Vivian B. Lewes for the introduction of water gas into coal-gas retorts. The action was a nullity suit in regard to this patent; and the Court upheld, on appeal, the decision of the German Patent office that the patent should be declared void, and ordered the appellants to bear the costs of the appeal.

GAS BILLS FOR 1906.

A COMPLETE set of the Gas Bills that have been introduced for promotion in the ensuing session of Parliament is now before us; and from the measures we supplement the outline of the proposals as originally presented by the notices given last November. The Bills of the Companies seeking incorporation are first brought under review, and are treated in alphabetical order.

The limited Company carrying on business as the Crediton Gas Company are seeking to considerably expand their operations under the new appellation of the Crediton Lighting and Power Company. They ask to be dissolved, reincorporated under the new title, and established for the purpose of manufacturing and supplying gas and electrical energy (within an area proposed to be extended by the Bill) for lighting, heating, power, and other purposes, and of conducting the usual business of such concerns. The capital of the Limited Company is £15,000, divided into 450 ordinary £10 shares, 400 preference shares, and £4500 of borrowed money. It is proposed that the capital of the new Company shall be £27,000—£10,000 original and £17,000 additional. It is provided in connection with the latter that the Company shall not issue a greater nominal amount of additional capital than shall be sufficient to produce, including premium, the sum of £18,000. In respect of borrowing powers, one-third of the whole of the issued capital is desired. The standard dividends are to be 10 per cent. on the original capital, 7 per cent. on the additional capital, and 5 per cent. on the preference capital. The standard price of gas within Crediton is proposed at 5s. per 1000 cubic feet; and in other parts of the limits of supply at 6s. Applying half yearly, it is intended that variations in the price shall carry 2s. 6d. changes in dividend in respect of every penny rise or fall in the standard price. Provision is to be made for the formation of insurance, renewal, and reserve funds. It is to be enacted that the Auditors of the Company shall be chartered accountants. The illuminating power of the gas is placed at 14 candles; and the Company are making provision for conforming with the testing of gas in the Metropolis by the following clause:—

> The testing-burner shall be of such a pattern (not being an incandescent or similar burner) as shall be practicable for use by the consumers; and the burner and chimney (if any) shall be the most suitable for obtaining, and in making the test shall be so used as to obtain, from the gas when consumed at the rate of 5 cubic feet an hour, the greatest amount of light. And the burner to be used for testing the Company's gas shall be that adopted for testing that of the three Metropolitan Companies.

In reference to the electric lighting part of the Bill, the repeal of the Crediton Electric Lighting Order is contemplated. The area of supply is intended to coincide with that for gas; but there is a compulsory area within which a general supply is to be available within two years. The rates of supply scheduled to the Bill are for any amount up to 20 units, 13s. 4d.; for any amount beyond 20 units, but not exceeding the equivalent of 91 hours of supply at the maximum power which has been demanded, 8d. per unit; and for any further amount exceeding the equivalent of 91 hours of supply at that maximum power, at the rate of 4d. per unit. Part of the gas-works site is to be utilized for a generating-station. Regarding discounts, 10 per cent. is proposed for prompt payment, and for large quantities "upon such scale, and subject to such conditions and regulations, as may be prescribed by special contracts in writing between the Company and any such consumers." The promoters ask for power to purchase by agreement an additional 5 acres of land. Separate accounts are proposed for the gas and electricity undertakings; and in order that the electricity consumers may be defended, it is intended to enact that, whenever the receipts exceed the expenditure on the electricity undertaking, a 7 per cent. dividend on the capital involved, and the contributions to the renewal and insurance funds, the Company shall make such a rateable reduction in the charge for the supply of energy as, in their judgment, will reduce the surplus to the maximum rate of profit. It will be within the recollection of readers that the District Council have decided to oppose the electricity part of the Bill, and support a reapplication by the private holders of the Electricity Order, who have not complied with its instructions that the powers should be transferred to a registered Company within a specified period. [*Parliamentary Agents: Messrs. Lees and Butterworth.*]

Dissolution and incorporation are sought by the Dowlais Gas and Coke Company, who have a present capital of £27,000, divided into 500 £10 shares, 500 £8 shares, 1000 £6 shares, 500 £4 shares, and 10,000 £1 shares, all of which are fully paid up. The preamble discloses that the Company have not borrowed anything on mortgage, but have spent nearly £2000 for capital purposes out of revenue on works to provide for the increased demand for gas, and they have also a reserve fund which has been built up from revenue. The Bill is merely one to extend the powers to meet the development that is taking place. The capital proposed is £64,000 consolidated ordinary stock, carrying a dividend of 5 per cent. Of this sum it is suggested that £54,000 shall be deemed to represent the original capital, and £10,000 the additional capital. The holders of the original capital are therefore to receive of the consolidated 5 per cent. stock just double the nominal value of their present holdings.

Borrowing powers are asked for up to one-third of the original capital existing at the time of the passing of the Act, and of the fully paid-up issues of the additional capital. A standard price of 4s. 6d. is proposed; and the sliding-scale is applied on the basis of 1s. 3d. variations in respect of penny reductions and increases in price in any half year. Regarding prepayment meter supply, the Bill intends to stipulate that money placed in such meters shall not be deemed to have been paid to the Company until they shall have actually received it. Tenpence per 1000 cubic feet is the excess price asked for meters and fittings, with the right to charge 1d. extra for any less quantity than 100 cubic feet. Without fittings, the maximum charge proposed for the hire of a meter is 10 per cent. The illuminating power of the gas is intended to be 14 candles, tested by Sugg's No. 1 "London" argand burner (with a 6 in. by $1\frac{3}{4}$ in. chimney, or a 6 in. by 2 in. chimney if at any time the gas-flame rises above the top of the glass), or such other burner as shall for the time being be approved by the Board of Trade. In respect of discounts, 10 per cent. for prompt payment and 15 per cent. for large consumption are mentioned. By a section towards the end of the Bill, the Company wish to be empowered to "enter into contracts and agreements with the Corporation of Merthyr Tydfil for the supply of gas in bulk for public lighting at such rate per lamp as may be mutually agreed between the Company and the Corporation." The Company desire to purchase by agreement up to 5 acres of land. [*Parliamentary Agents: Messrs. W. & W. M. Bell.*]

In seeking to be incorporated, the Llandrindod Wells Gas Company define the limits within which they wish to supply, and suggest a total capital of £15,000, in 3000 £5 shares, and one-third borrowing powers. In addition to land scheduled for the works, the Company ask for power to purchase not exceeding 5 acres by agreement. The maximum price of gas is intended to be 5s. for 14-candle illuminating quality. Clauses are inserted in the Bill for the protection of the District Council in respect of the opening of roads and the laying and alteration of the position of pipes. Not less than 2 feet are to intervene between the surface of roadways and the upper surface of mains and pipes. For changes in the position of mains or pipes necessitated by the work of the Council, the Company have agreed to pay. [*Parliamentary Agents: Messrs. Baker and Co.*]

The Mid-Oxfordshire Gaslight and Coke Company's Bill foreshadows a considerable scheme of combination for purposes of gas supply. The promoters are a Company registered under the above title with a nominal capital of £50,000, divided into 2500 ordinary £10 shares and 2500 £10 preference shares. The Company have agreed to acquire the works of the Eynsham Gas Company, Limited, the Charlbury Gas Company, Limited, the Shipton-under-Wychwood Company, and the undertaking of the Bampton and Aston Water and Gas Company. They have also acquired or entered into agreements for the acquisition of certain other undertakings, properties, rights, and privileges belonging to the following Gas Companies: Bicester, Chipping Norton, Witney, and Woodstock. The area of supply is thus an extensive one. In addition to the scheduled sites, the Company ask for power to purchase by agreement lands not exceeding in the whole 20 acres. The price of gas proposed is 5s. 6d. per 1000 cubic feet; but the Company ask to be allowed, if they think proper, to supply at different prices in different parts of the area. Discounts not exceeding 10 per cent. for prompt payment and 15 per cent. for large consumptions are contemplated. Fourteen-candle power gas is proposed, tested by means of a Sugg argand for gas of such illuminating power, or such other burner as shall for the time being be approved by the Board of Trade. Concerning prepayment supply, 10d. for meter and fittings, 1s. for meter, fittings, and cookers, and 6d. for meter alone, are the excess prices specified. The Company ask for power to apply for an Electric Lighting Order or Licence. In regard to capital, the following unusual clause appears:

> The moneys expended, or to be expended, by the Company for capital purposes in executing the powers of this Act shall not, save with the consent of the Board of Trade, exceed in the aggregate the sum of £70,000, whereof not more than £50,000 may be raised by the Company by the issue of ordinary or preference share capital, and not more than £20,000 by borrowing.

The interest on borrowed money is not to exceed 5 per cent. The Company take power to enter into leases and working agreements; and a clause appears empowering the borough authorities of Woodstock to lease to the Company for any term not exceeding 99 years certain lands and premises already in lease from them to the Woodstock Gas Company, and any other gas-works, lands, or premises which may be required or desired by the Company. The Bill contains clauses confirming agreements made with the Woodstock, Chipping Norton, Bicester, and Witney Gas Companies, and a confirmation of the lease of the Bicester Gas-Works to Edward Staff Prior. Protective clauses are inserted in favour of the Woodstock Corporation. From the schedules to the Bill, it is learned that the purchase price or consideration for the Woodstock works is £2425; and how this is to be paid by cash and stock is defined. To the Chipping Norton Company £7150 is to be paid, partly in cash and stock, £355 in cash as dividend at the rate of 5 per cent. for the year ending June 30 next on £7100, and the residue of the consideration is satisfaction of all debts, &c., of the selling Company on the same date. Sums of £2400, £700, and £600 constitute the prices and considerations to be paid, in cash or stock, to the Bicester Company. To the Witney Gas Company £3000 in cash is to be paid, an allotment made of 2500 5 per cent. preference shares of £10 each, an overdraft at the bankers of £1600 is to be paid off, and the satisfaction of all claims on the part of the holders of £4500 of debenture stock. In each case, provision is made for certain liabilities being taken over by the promoting Company, and the bearing by them of expenses, as well as the purchase of the stock-in-trade, &c., by valuation. Among the schedules to the Bill is an indenture made between the Bicester Gas Company and the lessee of the works. [*Parliamentary Agents: Messrs. Baker and Co.*]

The Truro Gas Company's Bill has pronounced features of considerable interest. It is a limited concern; and the Company are now applying for incorporation and statutory powers. Their authorized capital of £25,000 and borrowing powers are nearly exhausted—in fact, the authorized capital has all been issued, and will shortly be fully paid up. The sum borrowed is £8000; and debenture stock to that amount has been issued, bearing interest at the rate of 4 per cent. The Bill defines the limits of the Company's area, and, in respect of capital, proposes £60,000, whereof £37,500 is to be ordinary stock in substitution for the existing share capital, and £22,500 the additional capital. Including the £8000 already borrowed, the Company ask to be allowed to borrow up to one-third of the issued capital. The standard dividend is to be 5 per cent.; and the standard price 4s. 3d. per 1000 cubic feet. In respect of any half year or year, reductions or increases of 1d. in the price of coal gas will carry increases or reductions of dividend at the rate of 23. 6d. per cent. per annum. The Company ask to be permitted to charge in that part of the limits of supply outside the central area a price not more than 1s. per 1000 cubic feet in excess of the price of coal gas for the time being charged within the central area. The most modern form of clause in respect of excess charges for a prepayment supply has been adopted—viz., 10d. for meter and fittings, 1s. including cookers, and 6d. for meter only. The standard illuminating power for coal gas is proposed at 13 candles; and its testing is to be carried out by Carpenter's "Metropolitan" argand No. 2 burner, or such other burner as may be from time to time prescribed by the Board of Trade. The testing clause is, with the omission of two or three words, precisely in the form that Sir George Livesey published in the "JOURNAL" recently as having been drawn up for the South Suburban Company. [In the clause in the South Suburban Bill as issued, there are only a few verbal changes.] Reserve, insurance, and renewal funds are provided for; and in respect of the issue of capital, the Company ask for the privilege of offering it to consumers and employees before submitting it by auction or tender or to existing shareholders. The Company seek authority to construct a short tramway of 2 feet gauge; the motive power being either animal or mechanical. The Company also ask to be empowered to purchase certain lands by agreement, to an extent not exceeding 10 acres. They further desire the fullest freedom in respect of discounts—putting 25 per cent. as the limit of allowance for prompt payment; and, in consideration of large consumption, or in respect of gas supplied by contract or for motive power, upon such scale, and subject to such conditions and regulations, as may be prescribed by special contract in writing. The Company ask to be authorized to apply for an Electric Lighting Order; and the Directors, in conformity with modern practice, wish to be permitted to determine the salary of the Secretary. The section of the Bill relating to power gas has been reserved for notice after the above matters. The obligation to supply power gas to any owner or occupier of premises demanding it that are situated within 100 yards of a power-gas main is required by the Company, though the cost above 30 feet of main is to be defrayed by the consumer. The consumer will have to agree to take not less than 1 million cubic feet in six months, and to continue to receive and pay for a supply of power gas for a period of at least two years. The Company are not, under specified penalties, to supply the power gas for use in private dwelling-houses or for illumination; and the gas is to have a distinctive and readily perceptible smell. A "proportional" meter is defined for use for power gas. The Local Authority, or two Justices on the application of consumers, may appoint an examiner to test, between 8 a.m. and 6 p.m., the thermal power of the gas, which is to have a minimum heating value of 250 B.T.U. per cubic foot, at 32° Fahr. and 30 inches of mercury pressure, the product of combustion being cooled to 60° Fahr. For gas of this quality, 1s. 6d. per 1000 cubic feet may be charged. and for any higher calorific power an additional 1d. per 25 units. Penalties are prescribed in every direction for default. [*Parliamentary Agents: Messrs. Dyson and Co.*]

Mr. John Davies, the Manager of the Nantwich Gas-Works, whose death was recorded in the "JOURNAL" for the 12th of September last, left estate of the value of £1970. Sir Richard Nicholas Howard, who was formerly the owner of the Portland Gas-Works, and who died on the 25th of November, left estate of the value of £1060.

A new Swedish industry—the manufacture of Dinas bricks—has been started; it having been found that with the quartzite in Dalsland it is possible to make excellent bricks. Works were built at Köpmannabro in 1902, and in 1903 the output was 100,000 bricks, in 1904 it was 160,000, and in 1905 it will probably be found to have been 300,000. The bricks are from 10 to 20 per cent. cheaper than imported fire-bricks.

VERTICAL RETORTS FOR THE PRODUCTION OF ILLUMINATING GAS.

By W. R. HERRING, M.Inst.C.E., of Edinburgh.

The frequency with which the subject of vertical retorts and their adaptability to the production of illuminating gas appears in the columns of the "JOURNAL," prompts me to address to you a few remarks on the subject, which I hope may be of some use in directing the attention of gas engineers to the subject from the point of view from which, in my opinion, it should be approached. Notwithstanding the very important decision which the Directors of the Imperial Continental Gas Association recently announced, relating to the equipment of their Mariendorff works with the inclined retort system after an extended experimental experience with the vertical system—a decision with which I fully agree, in view of the fact that the model on which they have experimented was of such an elementary character as compared with what actually exists elsewhere—British gas engineers will not necessarily be deterred from giving the matter that close attention which such a system, on the face of it, appears to deserve. I say this, particularly in view of the fact that we are within a reasonable distance of being relieved of the necessity of paying such primary regard to the question of the production of illuminants, as distinct from the production of the highest possible quantity of gas, as represented by volume *plus* calories.

The interminable disputations which have accompanied the introduction of any really radical change in the process of gas manufacture in British gas-works in the past—notably the introduction of the gaseous system of heating retorts and more lately the inclined retort system of coal carbonization—will undoubtedly also accompany the system at present under discussion, particularly in view of the fact that the margin for bringing about economy in manipulation is now so much reduced—that is to say that when carbonizing with horizontal retorts and machinery costs an average of 2½d. per 1000 cubic feet, and the best system of inclined retorts costs 1d. per 1000 cubic feet, if the entire amount required to work the inclined retort system were wiped out (which, of course, is impossible) it would not represent the economy that has already been achieved by the inclined retort system. If, however, we cannot save pence, we must yet seek after the half-pence; and, therefore, every consideration should be given to the newer subject.

It does not appear that any serious regard has been given to the fact that in Scotland hundreds of thousands of tons of material have been carbonized in vertical retorts, and continue to be so treated at the present moment. The history of the Scottish shale-oil industry is a record of the superiority of scientific engineering over adverse commercial conditions of which any country might well be proud.

In the early days, paraffin shale—which as readers know is practically the same as cannel coal, and is, in fact, used as such in many gas-works in Scotland—was distilled in the ordinary horizontal retorts made of cast iron, similar in every way to the gas-work settings. It is now about 37 or 38 years since the oil industry engaged in a fierce controversy over the respective merits of the vertical and the horizontal retort system of carbonizing. Mr. George Beilby, in a paper entitled "Thirty Years Progress in the Shale-Oil Industry," read before the Scottish Section of the Society of Chemical Industry in 1897, covered the ground, in chronological order, as to the rise and development of vertical retorts. Mr. Beilby says:

> "The vertical retort was a cast-iron tube, of oval or circular cross section, built vertically in an oven of brickwork. At the top of the tube was fixed a charging hopper, closed by a bell-valve; while the bottom end dipped a few inches under water contained in a shallow iron tray or pan. Every hour or so, a small quantity of spent shale was raked out from the bottom through the water in the tray, which served the double purpose of closing the retort and quenching the spent shale. After every draw, a corresponding quantity of fresh shale was introduced through the bell-valve in the hopper so that the heated portion of the retort was kept filled with shale. The volatile products were removed by an exit pipe at the upper part of the retort."

Such was the first vertical retort used for carbonizing oil-shale. We shall see in a little while what progress has been made with the development of this system, and the way it can be adapted to the purposes of coal gas manufacture.

Mr. William Young, who is so well known to your readers, was a pioneer in the development of the vertical retort; and in 1872 he patented a retort which had a twofold object—viz., the distillation of shale at a dull-red heat (which was known to be the best temperature for the production of the finest grades of oil) and the utilization of the 20 to 25 per cent. of carbon in the spent shale for raising the heat necessary for the distillation of shale in the upper part of the same retort, without the necessity for using a double-cased retort such as his first vertical retort of 1868.

The first application of the vertical retort to gas manufacture is recorded in "King's Treatise on Coal Gas," Vol. I., pp. 235–36, where an illustration is given of Andrew Scott's vertical retort, which was erected and worked at the Musselburgh Gas-Works in 1874. Among other things, the employment of steam for the purpose of utilizing the carbon in the residue resulting from the carbonization of shale is claimed as a means of adding to the volume of gas—the hydrogen and carbonic oxide so produced being enriched by the rich gas resulting from the distillation of the shale.

From this date onwards, the development of the shale-oil retort appears to have been one of continuous progress and steady improvement—indeed, we have to-day as fine a type of its class as can well be imagined.

It must not be forgotten that the essential characteristic of the shale-oil retort is to produce a vapour as distinct from a gas, (although with the best type a large volume of gas is produced per ton of shale carbonized); and after abstracting from it all the products obtainable, the gas is returned to the retort-bench and there used for the heating-up of the settings.

It does appear to me that if the vertical retort system of carbonizing is to become a practical success for the production of illuminating gas, we have in the type already referred to the complete physical characteristics upon which development must take place. Most of the physical problems have already been solved for us; and it is amazing to reflect upon the crude character of the vertical retorts that have hitherto been the only examples put before the gas industry, when there are such really scientific examples of what such retorts should be, in continuous use in our own country.

For the present, therefore, my only object is to suggest that the gas industry must begin where the oil industry at present stands, and that to approach the subject as though vertical retorts were a new thing is a lamentable error on the part of all those who are taking an interest in this subject, and must inevitably lead to disappointment, discouragement, and possible discredit to the system.

I hope in a little while to send you a drawing of one of the best types of vertical retorts at present in use in Scotland, modified in such ways as appears to me to be the line of development necessary to be taken to adapt them to coal gas manufacture. At the same time, I propose to deal with the question of working costs and possible efficiency, in the hope that others who have had experience with these very retorts may take up the subject or openly express their opinions as to whether or not such developments as I have indicated are reasonably practicable.

NAPHTHALENE AT SHEFFIELD.

By HANBURY THOMAS.

IN the "JOURNAL" for Dec. 19, reference was made to the processes of Mr. J. Ferguson Bell and Mr. Alfred Colson having been tried at the works of the Sheffield United Gaslight Company—Mr. Colson's at Effingham Street, and Mr. Bell's at Neepsend and Grimesthorpe. Both these processes were experimented with in 1904; but the results then obtained were not so satisfactory as they have been during the past year. In fact, so far as Mr. Colson's process is concerned, no benefit was derived from it whatever; and the opinion of Mr. Colson, and of the Company's Engineer (Mr. J. W. Morrison) was that the cause of its failure was due to its not having been started until late in the season (Aug. 11), when a considerable deposit of naphthalene was in the mains. Last year (1905) it was decided to commence both processes in April, before naphthalene had made its appearance in the districts; and the following figures will show the advantage that has been derived:—

TABLE A.—*Number of Naphthalene Complaints Attended to from April 1* to Dec. 31 for the Years 1901 to 1905.*

—	1901.	1902.	1903.	1904.	1905.	Number of Meters in each District, June 30, 1905.
Neepsend . . .	13,675	1445	3927	1041	101	33,437
Effingham Street.	4,534	882	653	1646	34	14,053
Grimesthorpe. .	374	302	682	1163	17	9,140
Arundel Street .	2,070	678	1642	1426	67	11,196
Granville Hill. .	4,738	1255	1912	2164	73	3,382
Shude Hill . .	1,009	262	444	632	31	7,503
Total for Company's entire district . .	26,400	4824	9260	8072	323	78,711

* Leicester process started at Effingham Street, April 10; Derby process started at Neepsend and Grimesthorpe, April 13, 1905.

The areas supplied from Arundel Street, Granville Hill, and Shude Hill obtain their gas from both the Neepsend and Grimesthorpe works. It is delivered to governors at a high pressure, and distributed therefrom into the districts.

Mr. Bell's process was adopted for the Neepsend and Grimesthorpe stations, on account of the more favourable results shown at Neepsend, where it was tried in 1904; only last year there was a difference, which possibly accounted for the diminution of complaints in that district. In 1904, in addition to the solvent, the hot gas was washed with tar; and in 1905 the solvent only was used—Mr. Bell holding the opinion that, the Sheffield Company's gas being of a higher illuminating power, and showing by the

Colman test less naphthalene than that supplied at Derby, the tar washing was rather detrimental than otherwise. As regards effectiveness, there does not appear to be much to choose between the two systems, as, though the Neepsend figures show a rather larger proportion of complaints to the number of consumers than Effingham Street, the Grimesthorpe figures are more favourable to the Derby process. There has been only one complaint during the last three weeks; and the treatments have consequently been discontinued at Neepsend and Effingham Street.

Prior to the year 1887, naphthalene had never been seen in Sheffield. It may be remembered that the summer of that year (the Queen's first Jubilee) was an extremely hot and dry one. When the Company were first troubled with it, Sir Frederick Mappin, the Chairman, took the matter up, and has ever since given it his most earnest attention—having insisted from the very beginning that there must be a remedy, and that it ought to be, and eventually would be, found. The above figures, and the experience at Derby and Leicester, seem to prove that he was right, though most authorities had come to look upon naphthalene as an evil which, while it admitted of mitigation, had to be put up with. Readers of the "JOURNAL" will be aware that Sir Frederick has never failed for many years at the various meetings of the Company to draw attention to this subject; and he has spent a very large amount of time in consultation with the Company's officials, as to the method of working, and measures to be employed, with a view to overcoming the difficulty. The Company's Engineers have visited many works in the kingdom, both where naphthalene was experienced and also where there was freedom from it; and numerous plans have been tried. The following table shows the number of complaints, &c., each year since 1887:—

TABLE B.

Year.	No. of Meters in Use.	No. of Naphthalene Stoppages Attended to.	Gas Made per Ton of Coal Carbonized.	Average Quality of Gas Supplied during the Twelve Months.
			Cubic Feet.	
1887	44,147	1,230	9,849	17·76
1888	45,520	535	10,127	17·61
1889	47,231	1,693	10,124	17·56
1890	48,372	5,073	10,244	17 52
1891	49,523	577	10,406	17·52
1892	50,468	227	10,071	17·40
1893	50,818	524	10,217	17·51
1894	50,945	485	10,346	17·92
1895	52,320	953	10,425	18·00
1896	54,155	410	10,430	17·73
1897	55,709	871	10,355	17·77
1898	58,503	5,530	10,149	17·84
1899	61,459	20,229	10,276	17·50
1900	64,758	15,399	10,298	17·41
1901	67,950	28,181	10,278	17·34
1902	71,392	5,597	10,366	17·41
1903	74,815	9,664	10,363	17·37
1904	77,681	8,787	10,419	17·36
1905	81,894	532	10,506*	17·37

* The make of gas for 1905 is to June 30; that for the half year to Dec. 31 cannot yet be ascertained.

In the year that naphthalene first appeared, no alteration whatever had been made in the method of carbonizing over that of previous seasons. In fact, everything was the same as it had been for many years before. The make of gas was only 9849 cubic feet per ton of coal carbonized; and regenerative furnaces were not started until 1890, and then only to a small extent. They have, however, since been adopted at all the stations. Stoking machinery was first installed in one retort-house at Neepsend in 1891.

It does not appear that the make of gas has any direct bearing on the question, as reference to the table shows that in 1891, when 10,406 cubic feet of gas was made per ton, there were only 577 complaints. Again, in 1896, with a make of 10,430 cubic feet, there were only 410 complaints; whereas in 1899, when the same class of coal was used, and the make was only 10,276 cubic feet, there were 20,229 complaints, and in 1901, with a make of 10,278 cubic feet, 28,198 complaints. The quality of the gas in these years did not vary greatly; being 17·52 candles in 1891, 17·73 candles in 1896, 17.50 candles in 1899, and 17.34 candles in 1901. In this connection, Mr. Colson made a very interesting experiment. For a considerable period in 1901 and 1902, he worked with seven-hour charges and low retort temperatures, without experiencing any relief; and in October, 1902, when he reverted to six and five hour charges, high heats, and big yield of gas, he actually found his complaints were less numerous. In a letter to me he said: "Whether the improvement is to be attributed to this cause, I am not yet quite sure; but we are doing very well—much better than last year, when working seven-hour charges and lower temperature. I have made no other change."

Many remedies have been tried, among others the boarding-up of the condensers; it being considered that the effect of the sun on them was detrimental. A large extension of foul mains was made, in order to give the gas a longer travel inside the retort-house, so that very gradual condensation might take place before it reached the condensers outside, and additional water-cooled condensers were erected. A point that was almost universally recommended was that the temperature of the gas at the outlet of the condensers should not exceed 60°. This was tried from February, 1899, till November, 1901, when it was decided to test the effect of higher temperatures; it being considered that, in reducing the temperature so low, various solvents which might, if allowed to travel with the gas through the mains, prevent deposits, were condensed out of it. This proved to be to a great extent correct, as the following year (1902) the complaints fell to 5597—whereas in 1901 they were 28,189—and have never since reached the high numbers that obtained when condensation to low temperatures was in vogue. Prior to the year 1899, no particular attention was paid to the outlet temperatures, which were allowed to rise and fall with that of the atmosphere.

It was formerly considered that naphthalene was deposited in the mains in the winter months, and carried forward to the consumers' services in the summer. This idea is not borne out by experience at Sheffield, as for several years examinations made of a number of trunk and other mains showed no signs of it until early summer, when crystals were noticed on their interiors. These mains have been subjected to monthly inspection; and it has been found that all traces disappeared in the winter. Moreover, the complaints have always diminished during the later months of the year, have disappeared altogether in the early spring, and have not again broken out in any number until the following summer. An outburst of hot weather was then sure to augment them considerably; and they would thereafter be prevalent for the rest of the season—showing increases with sudden variations of temperature either for hot or cold. The officials of the Company during the past year enjoyed such peace of mind as has not been known to them for a very long period; and they look forward with hope to being spared the anxiety and never-ceasing worry they have been accustomed to endure for many years.

As has been previously announced in the "JOURNAL," the Directors of the Company are much gratified with the great improvement that has been effected; and at the last meeting of the Board they decided that some acknowledgment was due to both Mr. Bell and Mr. Colson for the intelligence they had displayed in working out a most difficult problem, and for placing the results of their exertions at the Company's disposal. It has been the custom of the Company for some years past to send to both Mr. Colson and Mr. Bell a monthly account of the number of naphthalene complaints dealt with; and they have supplied the same information to Sheffield. Notes of what was being done at the works of each to overcome the difficulty, have also been freely exchanged.

PARIS SUBURBAN GAS SUPPLY.

The New Works at Gennevilliers.

IN a previous issue of the "JOURNAL," some particulars were given in regard to the new Company—the Société d'Eclairage, Chauffage, et Force Motrice—which was formed about two years ago to supply gas in the suburbs of Paris on the expiration of the Paris Gas Company's concession on Sunday last. It was then mentioned that contracts had been entered into for the construction of works at Gennevilliers and the erection of two gasholders for the suburban service. Before this was done, however, it was necessary to obtain the sanction of the Prefect of the Seine and the Hygienic Council; and in order that they might be fully informed as to the extent of the new industrial establishment and the nature of the work to be carried on therein, two reports were made to them by M. Jungfleisch. From these we have been able to obtain the following particulars of the general arrangements, which may possibly have been modified in certain details since the reports were presented.

Dealing first with the works, they are situated at Gennevilliers, on the extreme north of the peninsula; the site forming part of the tract of land irrigated by means of the sewage of Paris. The site is accessible from the Seine, and the works are connected with the Northern of France Railway by a branch line. The town of Gennevilliers is nearly 1000 yards from the works; and Epinay, on the other side of the river, is quite as far off. Various objections were raised by private individuals and certain public bodies to the construction of the works; but, on inquiry being made into their complaints, they could not be substantiated. The Municipal Council of Gennevilliers discussed the subject, and, by a majority of five, gave a decision in favour of the works. The delegates of the Hygienic Council expressed the opinion that the site selected by the Company was, as regarded isolation, specially advantageous for the work intended to be carried on there, and that one more suitable would be difficult to find in the Department of the Seine. They pointed out that the processes connected with gas manufacture had been so greatly improved, as the result of study and experience, that any inconvenience arising from them would not be intolerable.

The new Company have obtained a concession for thirty years from the 1st inst., for supplying gas in about 78 communes, mostly in the Department of the Seine, but some in that of the Seine-et-Oise. In 1901, the consumption of gas in the suburbs of Paris amounted to about 106 million cubic feet per annum. But since then it has increased very considerably, owing to a reduction in price. The Company therefore thought it advisable to arrange for the annual production of 212 million cubic feet of gas, which

would necessitate the carbonization of 200,000 metric tons of coal, to allow for extension of the works as required by increased consumption, and to treat on the works all the residual products. They accordingly acquired a site some 126 acres in extent. It lies below the level of the high road from Paris to Epinay; but the buildings stand on ground which has been raised to that level. A portion of the site is enclosed by a wall 10 feet high; but the most isolated part has only a ditch with sloping bank, which is considered to afford sufficient protection. The works comprise retort-houses, coal-stores, purifier, exhauster, meter, and governor houses, and buildings to contain the plant for the treatment of the residuals. They are connected with the existing distributing system by a trunk main, which runs round Paris, and is fed by gasholders at the works as well as at Boulogne-sur-Seine and Alfortville. In order to ensure the continuity of the service, all the manufacturing plant is in duplicate. There will eventually be three retort-houses; but only one has, we believe, been completed. It is about 400 feet long and 184 feet wide; and it contains two benches of eight settings of nine retorts, arranged in parallel—the intervening space being ample for charging and discharging. These operations will be performed by either the Paris or the Lyons machines. The retorts are horizontal "throughs," and each will hold 9 cwt. of coal, and yield, with six-hour charges, about 5300 cubic feet of gas. The settings are heated by generator furnaces; the waste gases being conveyed to the extremity of the house and utilized for raising steam. The coal-store has a capacity of 8000 metric tons. The retort-settings and the general arrangements of the house are similar to those at the Landy works of the Paris Gas Company. The retort-stoking machinery is operated from a platform, below which will be the coal-breakers, the baths, and the men's rooms. The coke is removed by a conveyor into the open air, quenched, and sent away in waggons.

The condenser runs round the retort-house; and on leaving it the gas goes through the usual plant to the purifiers, placed in a group of buildings in the centre of the works. The boxes are located upon the ground floor, the upper floor being reserved for the revivification of the spent material. The exhausters are of the Beale type. The station meters are equal to passing close upon 3¼ million cubic feet of gas per day. There are two gasholders, each of about 2¼ million cubic feet capacity, built in above-ground tanks, supported by solid blocks of armoured concrete. The lower portion of the tank is of sheet-iron plates 1¼ inches thick, decreasing to ¼ inch in the upper part. The holders are 158 feet diameter, in three lifts, guided by twenty vertical and tangential rollers. The holder pressure will be 6, 9, or 10 inches, according as one, two, or three lifts are in use. The crown of it will rise to a total height of 164 feet. M. Jungfleisch remarked that the dimensions of the holders might be considered large when compared with those generally in use in France; but he pointed out that, as now constructed, there is a measure of solidity given to them which ensures safety, and that at East Greenwich and Birmingham very much larger holders are working highly satisfactorily. The Gennevilliers works will furnish gas for the half of the district nearest to them; the remainder will be sent from two other holders, similar in size, one situated at Boulogne-sur-Seine and the other at Alfortville, which will be fed from the works by a high-pressure main. These holders were made the subject of a special report, to which attention will be given later.

It has already been mentioned that the new Company work up their residual products. It is estimated that about 10,000 tons of tar and 27,000 tons of ammoniacal liquor will have to be dealt with. The buildings in which these operations are carried on form a rectangle, the centre of which is occupied by the tar-stills; the buildings nearest the gas-works being utilized for the production of sulphate of ammonia, and those farthest off for the manufacture of sulphuric acid and cyanides. The tar will be distilled in six vertical sheet-iron retorts, each having a capacity of close upon 7000 gallons; and there will be four classes of products: (1) Light oils, to be submitted to further treatment; (2) phenol oils, ready for the market; (3) creosote oils, to be sold after the separation of the naphthalene by crystallization; and (4) heavy oils and anthracene. The light oils will be re-distilled by heating with steam, to extract the more volatile parts or benzols, which are to be utilized chiefly for increasing the illuminating power of the gas. The plans originally submitted included complete experimental works, with a storage holder of about 175,000 cubic feet capacity; and also plant and a holder for the production and storage of water gas. We understand, however, that the latter plant has been abandoned.

Reference has already been made to the two auxiliary storage holders forming part of the scheme. They are of the same dimensions and capacity as those at Gennevilliers, and will be filled from the large main running round Paris. The gas will be carburetted on the works; and as the illuminating power may fall in the course of its journey to Boulogne, provision is made there for bringing it up to the standard specified. The stations are equipped with the necessary inlet and outlet governors, and arrangements have been made to prevent the freezing of the water in the gasholder cups.

The general policy of the Standard Oil Company, it was stated at a company meeting in the City the other day, has led the Government of the United States to institute a Commission to investigate the conduct of its business.

CHARRED COAL.

By W. D. Scott Moncrieff.

As it is considered that it would be of interest to lay before readers of the "Journal" a review of the matters touching upon my proposal that the Gas Companies should turn their attention to the production of partially carbonized fuel (a question upon which I was speaking at the recent Smoke Abatement Conference in London), I first thought of making a *résumé* of the opinions expressed in the papers read before the conference, and of tabulating them, in order to find out what weight of evidence there was in favour of such a suggestion. Upon perusing the papers, I found that they may be grouped under three headings:—

(1) Those containing proposals for dealing practically with the problem of smoke abatement.
(2) Those that are taken up with the facts and figures of the evils arising from fog and smoke.
(3) Those that deal with the law on the subject of smoke and its application.

Under the first heading, I was surprised to find that there was a complete agreement as to the necessity for separating the gaseous from the solid constituents of the coal, in order to obtain immunity from smoke; and this is in complete accord with the position maintained just twenty-five years ago in a paper that I read before the Society of Arts, entitled "Smokeless London." The conclusion arrived at by the conference means that the hopes so long entertained, of being able to ensure a smokeless atmosphere from specially devised domestic grates, so far as the writers of the first group of papers are concerned, have been altogether abandoned. This conclusion is embodied in a sentence in Dr. Des Vœux's paper, in which he states: "Broadly speaking, it may be said that there is no such thing as a smokeless open coal fire."

Seeing that it requires some six hours treatment in a red-hot retort to remove all the gas from bituminous coal, twenty-five years seems a long time to have taken to come to the conclusion that the same result is not likely to be achieved by a housemaid in an open grate; and I think that the recent conference will have done good service if it makes this conclusion final. If it is absolutely necessary to separate the gaseous from the solid constituents of the coal, the problem then resolves itself into dealing with the separated parts; and this really was the chief subject matter of all the papers that come under the heading of practical proposals.

Taking the papers in the first group, the practical suggestions come under five heads: (1) The use of gas made by the London Gas Companies; (2) The use of producer gas for heating; (3) The production of gas at the coalfields and conveyance in pipes under pressure to London; (4) The suggestion made by Sir Charles Cookson, which is identical with that made by Sir Wm. Siemens twenty-five years ago, for using coke supplemented by gas; and (5) A proposal made by the same writer that "charred coal" from which a certain proportion of gas has been removed, should be used.

In dealing with the first three of these suggestions, which recommend the use of gas, there is a general objection that they do not appeal to the ordinary householder as any improvement upon a clear burning coal-fire. Even if the illuminating standards now required were lowered, gas obtained under existing conditions from the gas companies would be more expensive than coal. Producer gas for heating purposes, even if cheaper than coal, would entail an enormous expense for distribution; and this would be still heavier in the case of gas brought from the coalfields. Dealing with the proposal that coke should be used supplemented by gas, Sir Charles Cookson himself admits that the supply of the former would be inadequate; and the fifth proposal, for the use of "charred coal," I will now deal with as it was suggested by me in a letter that appeared in "Nature" for Dec. 16, 1880, as follows:

Smokeless London.

"I write for the purpose of expounding a scheme which, if adopted, would make London a Smokeless City. When taking upon myself to explain a subject in a few minutes which has taken many years to develop in my own mind, there is a great temptation to put the reader in possession of the steps which led to the conclusion. The conclusion itself, however, has so much to recommend it that I will confine myself to the results of my reasoning only. It is enough to say that they were arrived at, to a great extent, by an exhaustive exclusion of less feasible plans. First, then, I propose to take advantage of the existing plant of the gas companies. I find they are amply sufficient for the purpose.

"Instead of taking 10,000 cubic feet of gas per ton from the coal, I propose to take 3333 cubic feet, and to pass three times the quantity through the retorts, or any other proportion that may be found most convenient. The result of doing so is startling. The companies will have doubled the quantity of bye-products they have at present in the shape of tar and ammoniacal liquids; the community will have 24-candle gas instead of 16-candle gas; the fuel resulting from the process will light readily, and it will make a cheerful fire that gives out 20 per cent. more heat than common coal. London would become a smokeless city.

"In dealing with the figures, I shall take them roughly, but in such a way that by including a few outlying corporations they could be made absolutely correct. I take the total annual consumption of coal in

London to be 6 million tons. Of this, I take 2 million tons to be the annual consumption of the gas companies. The total quantity of fuel used for general purposes I take to be 4 million tons of coal and 1 million tons of coke sold by the gas companies. We shall now see what would be the result if we treat the whole of the 6 million tons in the retorts on an extraction of less than three hours, instead of the six hours at present prevailing.

"The total quantity of 16-candle gas consumed in London may be taken at 20,000 million cubic feet. This would be at the rate of 3333 cubic feet per ton upon 6 million tons, the quantity of coal consumed in London. The residual smokeless fuel would amount to 5,100,000 tons. Of this, 1,000,000 tons would be required for the extraction of the gas; leaving 4,100,000 tons available for the general uses of the community. This has to be compared with the 4,000,000 tons of coals and the 1,000,000 tons of coke already referred to as consumed at present. Now, the smokeless fuel which results from an extraction of 3333 cubic feet of gas per ton has a heating capacity fully 20 per cent. greater than common coal, and 10 per cent. greater than coke. This gives us the exact equivalents of the 5,000,000 tons of fuel at present in use.

"So far the account as regards the fuel available for the community balances. We may now deal with the difference in value between 16 and 24 candle gas. As the value of the gas varies directly as its illuminating power, the calculation is very simple. If we take the average price of 16-candle gas to be 3s. 6d. per 1000 cubic feet, we shall find the total value of the 20 millions consumed in London to be £3,500,000. But as we have by my scheme the same quantity of 24-candle gas, the value will be increased to £5,250,000, Here, then, we have an annual sum of £1,750,000 to place to the credit of the system.

"Turning, now, to the bye-products; seeing that the gas companies by the new arrangements would subject three times the quantity of coal to the heat of their retorts during the period when the tar and ammoniacal liquors pass off most rapidly, I do not think I am wrong in estimating the yield at double its present amount. Taking this upon the tar and ammonia to yield 3s. 9d. per ton of coal, we find the total value of these bye-products to be, at present, on the supposed consumption by the gas companies of 2,000,000 tons of coal per annum, £375,000. This being doubled under my scheme, an additional sum of £375,000 must be placed to its credit.

"But the basis upon which we have hitherto been arguing is that the gas companies under the proposed scheme are getting their coal for nothing. We have been supposing that the community become the purchasers of 6,000,000 tons of coal and hand it to the gas companies. At present, London only pays for its general consumption on 4,000,000 tons of coal and 1,000,000 tons of coke. Let us now suppose that the companies pay the same sum annually that they do at present for their coals; if so, they would pay upon 2,000,000 tons, or an annual amount of £1,600,000, if their coals cost 16s. per ton. From this falls to be deducted the money they at present draw from their sales of coke, which, when taken at 6s. per ton of coal carbonized under the existing system, still leaves a sum of £1,000,000, which they could afford to pay per annum for the use of the 6,000,000 tons of fuel as proposed in my scheme. We will now take the total payments of the community for their coal to be upon 6,000,000 tons, for which we will further suppose they pay at the rate of 16s. per ton first cost. This would amount to £4,800,000 per annum. From this falls to be deducted the £1,000,000 contributed by the gas companies for the use of the fuel, also the £1,750,000 charged on the difference between the 16 and 24 candle gas already referred to; also the sum of £375,000 of additional income from the bye-products. This would leave a net sum paid by the community for its fuel under my scheme of £1,675,000. Under the present system they have to pay (say) 16s. per ton on 4,000,000 tons of coal, and (say) 12s. per ton on 1,000,000 tons of coke. This makes in all the sum of £3,800,000 per annum. Here, then, we have a balance in favour of my scheme of £2,125,000 annually. This may be taken as the yearly value of London smoke, which I propose to convert into useful products by *the plant at present in use.*

"I have only, in conclusion, to say one or two words about the efficiency of the scheme as regards the fuel. It lights easily, it gives off no smoke, it makes a cheerful fire, it gives out more heat than either coal or coke, it will be cheaper per heat-unit than the coal at present in use, London would become a smokeless city, and all that would fall to be deducted from the sum of £2,125,000 per annum would be confined to a few items, such as the cost of the additional workmen employed in charging the retorts, interest upon the additional capital required for transit appliances, and the terms to be made with the gas companies for carrying out the scheme."

The statements made in the foregoing letter will, of course, apply *pro rata* to the increased coal consumption in London at the present time. But the almost insuperable difficulty of achieving any success in England with a new idea upon its merits, and the indifference of the gas companies to any change in their methods during their long period of monopoly and prosperity, made me doubtful that any progress could be made until circumstances had altered. I think there is now some hope that the conclusions arrived at by the recent congress may pave the way to an effort being made in the direction I have indicated.

The general acceptance of the proposition that the gas must be separated from the coal, narrows the problem to a consideration of how this can best be done; and a statement made by Sir Charles Cookson, in the paper he contributed, seems to bring my proposals within a reasonable likelihood of their being seriously considered. Although his observations principally apply to a suggestion which, as I have already said, was made originally by Sir Wm. Siemens, and deal for the most part with the details of his experience in adopting them in his own house in London, he comes to a conclusion which is absolutely on all-fours with my own. He says:—

"All, or nearly all, the coke at present in the market is a bye-product of gas-retorts; and its quantity therefore is naturally quite insufficient to meet such a demand as my scheme contemplates in London alone. The only remedy for this is to produce 'charred coal,' which, after utilizing a part only of its valuable volatile products, could still be sold at a lower price than that of bituminous coal. This may be done, and has been done in Germany and elsewhere. Charred coal is produced by a newly-invented and more economical pattern of coking-oven in Germany for 8 marks per 1000 kilos. (equal to one ton); and there is no doubt that, with the progress of Science, its quality could be improved. And, if manufactured in England, as no doubt it will be when the demand arises, it could be delivered in London at a proportionally small cost."

I do not know if the German inventor has seen the paper I read before the Society of Arts or the foregoing letter, but, whatever the origin of the idea in Germany may have been, it is obvious that something has been done to put my scheme into practice. The gas companies, who are, I maintain, the proper persons to carry out the work, have fallen upon days of keen competition and smaller dividends; and they may now look at the subject from a business point of view. If so, I would be pleased to offer my services in connection with a Commission of experts or otherwise to go into the question of how "charred coal" can be produced. The smokelessness of London would follow; and there would be no necessity for turning the streets upside down for the distribution of gas for heating.

VOLUNTARY WINDING UP OF MESSRS. GRAHAM, MORTON, LIMITED

And the Founding of a New Firm.

The shareholders of Messrs. Graham, Morton, Limited, last Wednesday passed the following resolution: "That it has been proved to the satisfaction of this meeting that the Company cannot, by reason of its liabilities, continue its business, and that it is advisable to wind up the same, and accordingly that the Company be wound up voluntarily, and that a liquidator be appointed for the purpose of such winding up." A liquidator was immediately appointed, and steps have been taken for the sale of the property; so that practically the business of the firm is at an end, with the exception of the completion of such contracts as are now in hand. In consequence of this turn in the tide of the affairs of this until recently great and promising concern, Mr. Maurice Graham has had to consider what should be his own future course of action. His determination was not long in maturing; for he has already —showing that his energy has not been impaired by this misfortune—taken steps to secure premises in Leeds; and it is hoped that a not inconsiderable portion of the contracts that the Limited Company have surrendered by the liquidation will find their way into his hands.

There will, we venture to think, be a considerable amount of sympathy in the gas industry generally with those who built up the business and the reputation of the now expiring firm in the disastrous end to which an invalidating set of circumstances, which has pursued them with relentless persistency over the past few months, has brought the business. What those circumstances were will best be found by going lightly over the history of the Company. It was founded in 1898, to carry on the business of engineers and contractors, principally for coal, coke, and other elevating and conveying machinery, inclined retorts-settings, and steel structural work. In August, 1904, the authorized capital was £250,000, in 125,000 ordinary and 125,000 preference shares of £1 each; and public offer was then made of £80,000 7 per cent. cumulative preference shares at par. At that time the whole of the ordinary shares issued (66,605) were paid for and held by Mr. Maurice Graham and Mr. Joseph Morton (Managing-Directors), or members of their respective families. It is gathered from the then issued prospectus that no credit was to be taken in the balance-sheet of the Company for the goodwill of the business; and no part of the proceeds of the issue was to represent, or to be applied, in payment for goodwill. Preference shares to the number of 45,000, and ordinary shares to the number of 59,395, were held in reserve for future issue. It was also stated in the prospectus that the average annual profits for the four years ending the previous March amounted to £22,431; the profits of the last year of the period being given as £14,852. The estimate of the assets was £129,280, against a liability of £66,605 on the ordinary shares, and of £62,675 owing to creditors.

The foregoing is briefly the financial history of the Company to that stage; but to retrace our steps to the foundation of the concern. From then, it will be remembered its rise was phenomenally rapid. Early in the history, some very extensive contracts were (and this is a compliment to Mr. Graham's individuality) confided to the Company—the notable ones in gas-works being Granton for the Edinburgh and Leith Gas Commissioners, Milan, Genoa, and Nanterre (Paris) for the Union des Gaz (whose shares are held, and whose business is directed, in large measure by the Continental Union Gas Company), Leigh, Aberdeen, Leeds, &c. The success of the Company led to the erection of the extensive works at Pepper Road, Hunslet, which works were laid out with that comprehensiveness in the matter of detail which has been an inveterate characteristic of the work and doings of the head of the Company throughout his business career. Then came the great action (so recent as to be perfectly fresh in memory) between Messrs. Graham, Morton, and Co., Limited and the Union des Gaz over the Milan contract; and the circumstances that have brought about the downfall of the firm, there is no doubt

concentrate themselves about this action—mainly through loss of business, owing to the attention that such an action involved on the part of Mr. Graham, and the chiefs of the various departments in the employ of the Company. In fine, there was such a diverting of attention from business to litigation, and such a general disorganization in consequence, that the former naturally suffered to a lamentable degree, and so much so that profits were a *minus* quantity on the last financial year's working. In addition to this, the general expenses incurred in the action were, through the magnitude of the matters involved, and the vast amount of preparation entailed, enormously in excess of the taxed costs. This was, in such a case, almost inevitable. It will be remembered that the firm were suing the Union des Gaz for £4000—the balance of the contracts for the work at Milan and Genoa, while the latter made a counterclaim for £70,000 damages, which they alleged they had suffered owing to the character of the work. However, Messrs. Graham, Morton, and Co., Limited, left the Court triumphant on every issue; and with their business reputation not only unblemished, but enhanced by the Judge's verdict. When the results of the year's working, which had been so seriously crippled by litigation, became known, and when the whole of the monetary drainage through the litigation was ascertained, then it appears that a disinclination arose on the part of those who had been financing the business to further subsidize it, notwithstanding the large contracts the firm had in hand.

This brings the matter down to June last, when the Company was reconstructed under its present title of Graham, Morton, Limited. At that time—certifying so recently their faith in the future success of the business—Mr. Graham and Mr. Morton each subscribed for £3000 of preference shares, forfeited £30,000 of ordinary capital (for which they had paid cash), and paid all the expenses of the reconstruction of the Company). It cannot be said that, from the financial and every other point of view, these gentlemen did not do their utmost to save the concern—in fact, Mr. Graham himself tells us he has lost £36,000; but what they could personally do did not, or rather could not, avail very much. They were in a sense in "a tight corner;" material could not be obtained without credit, and they could not move farther than the peculiar circumstances of the case permitted. Although business was at hand, financial aid was not forthcoming; and there was then a conference of shareholders at Huddersfield on Dec. 6. At the meeting (the circular convening last Wednesday's meeting states) the shareholders were informed that further capital to the amount of £20,000 would be necessary to carry on the business; and a motion was adopted resolving to ask the shareholders to subscribe one-half of the amount *pro ratâ* to their holdings—the bank promising to consider the matter of advancing the remaining £10,000. The response of the shareholders, however, to the circular sent out was very disappointing; and therefore the bank refused to go any further than the £40,000 already advanced, and secured to them by first debentures (these debentures comprising the whole of the assets of the Company, including the freehold land, buildings, &c.). In consequence, a meeting of the Advisory Committee (representing the preference shareholders) and the Directors was held on Dec. 13; and a decision was arrived at that there was no other alternative than to send out the circular calling another meeting of the shareholders for the purpose, if thought fit, of passing a resolution voluntarily winding up the concern, and appointing a liquidator. That meeting was held last Wednesday, with the result stated—Mr. Robert Hilditch being appointed Liquidator.

In response to the circular referred to above, the shareholders only offered to subscribe some £5000; and therefore, as seen, the bank declined to go any farther. Seeing that the Company have had in hand some £140,000 of remunerative orders, it certainly seems, on the face of things, a pity that the shareholders did not more willingly render assistance, and save the business from total collapse; for out of the wreckage the preference shareholders themselves stand, so far as we can see, little chance of securing anything, while the ordinary shareholders cannot possibly get anything, although the assets of the Company were (we are informed) on Sept. 16 £139,000, and the liabilities, in addition to the debentures, only about £20,000.

The anxiety which Mr. Graham has passed through during the last few months must have been considerable, owing to the fact that he had his reputation to uphold, and had to carry out the contracts in hand with as little inconvenience as possible to the engineers of various gas-works, without betraying the unfortunate financial conditions under which he was working. While sorry to see this end of such a promising business, through the withdrawal of financial support on top of the great legal victory a few months ago, we hope that it will be long before the title of Messrs. Graham, Morton, and Co. will disappear from the gas industry; for it is under that style that Mr. Graham has decided to commence in business for himself, and will again apply his energies to reconstructing a firm to replace that which inexorable circumstances have removed from his management. We can but admire his courage and indomitable pluck, and wish him success.

EFFECTS OF FIRE ON COKE BREEZE CONCRETE.

Some interesting experiments to determine the relative value of various forms of concrete have been undertaken by the British Fire Prevention Committee, with a view to determining the fire-resisting qualities; and the following details of the results, taken from the Committee's "Red-Book," appear in the January number of "Fire and Water."

For the purpose of the test, six rolled steel joists, each 6 in. by 4½ in., weighing 20 lbs. per foot lineal, were placed across the top of one of the testing-huts; each joist being encased in coke-breeze concrete, 9 in. wide by 10¾ in. deep, so as to give not less than 2 inches thickness at any part of the joist. Upon these joists were laid seven bays or slabs of concrete—each of different composition—measuring 10 ft. 2 in. long by 2 ft. 7 in. wide and 5 in. in thickness. In each case 1·2 gallons of water per cubic foot were used. The material was turned both in its dry and wet state; and the concrete to form each slab was laid on the centring in a rather wet state, and lay for a fortnight before the centring was removed, on Sept. 28. The coke-breeze casing to the beam was rendered with ½ inch of plaster. During the week ending Oct. 7 last, each separate bay was loaded with bricks equal to a distributed load of 224 lbs. per foot super. From Oct. 16 to 23, a coke-burner was kept alight in the testing-chamber preparatory to the test on Oct. 24. The test commenced at 2 p.m., and continued for three hours, during which time the temperature rose from 840° to a maximum of 1920° Fahr. At 5 o'clock, the gas used for testing was turned off, and two jets of water at 65 lbs. pressure were directed upon the underside of the floor. During the test the plastering fell from the beams continuously. The edges of the slag, clinker, and Thames ballast slabs were observed to get red hot; but all the slabs remained in position.

The following are the seven forms of concrete tested, and the result of the test in each case. The principal component in all seven aggregates was broken small enough to allow it to pass a 1½-inch ring.

Slag Concrete (blast-furnace slag 3 parts, clean sand 2 parts, portland cement 1 part, by volume). Observations after test: Top: Slab cracked across in two places into about three equal parts, curved downwards about ¼ inch in the width. Soffit: Practically flat on underside; slight cracks visible, corresponding to those on top.

Broken Brick Concrete (broken brick 3 parts, clean sand 2 parts, portland cement 1 part). Effect of test: Top: Slab cracked across in three places into four rather unequal parts; very slight curve downwards. Soffit: Curved downwards ¼ inch in centre in width; slight cracks visible, corresponding with those on top.

Granite Concrete (broken granite 3 parts, clean sand 2 parts, portland cement 1 part). Effect of test: Top: Slab cracked across in three places into four parts, curved downwards about ½ inch in the width. Soffit: Curved downwards ½ inch in centre in width. About 1 inch washed off under surface in one part, and slightly more or less over area struck by water.

Burnt Ballast Concrete (burnt ballast 5 parts, portland cement 1 part). Effect of test: Top: No cracks; not curved. Soffit: Roughly curved downwards about ¼ inch in the centre in the width. About 3 inches in depth washed off under surface in one part.

Coke-Breeze Concrete (coke breeze 5 parts, portland cement 1 part). Effect of test: Top: No cracks; not curved. Soffit: Flat on underside. About 1 inch washed off surface generally all over, more or less, where struck by water.

Clinker Concrete (furnace clinker 3 parts, clean sand 2 parts, portland cement 1 part). Effect of test: Top: Slab cracked across in two places into about three equal parts, curved downwards about ⅜ inch. Soffit: Flat on underside. Surface pitted in places about 1 inch deep where struck by the water, and in one place 2 inches deep. One slight crack visible.

Thames Ballast Concrete (Thames ballast 3 parts, clean sand 2 parts, portland cement 1 part). Effect of test: Top: Slab cracked in very many places; cracks being generally transverse or across the slab, but in various diagonal directions as well. No actual longitudinal crack on upper surface; curved downwards about 2 inches in the width. Soffit: Curved downwards 1½ inches in centre in the width. Several bad cracks longitudinally in slabs extending over almost the whole area, worst about centre; the cracks being in various irregular directions. Surface damaged all over more than any of the other slabs; greatest depth about 2 inches, and a hole in north-west corner, through which daylight was seen.

Each beam had part of the concrete washed off to a depth of about 1 inch where it was struck by the water. No steel work was exposed.

Our contemporary gives a sketch plan of the top of the testing hut, showing the arrangement of the materials.

At the Montreal Water-Works there has been installed a high-lift turbine pump, operated by an electric motor. It is designed to raise 3800 gallons of water per minute against a total head of 300 feet, requiring the expenditure of 450-horse power. The set runs at 740 revolutions per minute, and, according to "Iron Age," it has an efficiency of 78 per cent.

Many of our readers are aware, from the receipt of pictorial post-cards, that Mr. J. T. Westcott, the Manager of the Economical Gas Apparatus Construction Company, Limited, has been making, with his family, an extended tour in America and Canada. They will doubtless be pleased to learn that the party all arrived back in England safely just before Christmas.

VERTICAL RETORTS FOR PRODUCING COAL GAS AND WATER GAS.

A French patent has been taken out by M. Rummens for a setting of vertical retorts for the simultaneous production of a mixture of coal gas and water gas. His specification is given in the last number of the "Journal de l'Eclairage au Gaz et à l'Electricité," from which the following particulars are extracted.

The general arrangement of the setting is shown in the accompanying illustrations. The retorts have double walls A and movable bottoms B. The outer wall is solid and vertical, while the inner one is perforated and inclined in such a way that the retorts are of smaller section at the top than at the bottom. Consequently, on the withdrawal of the sliding bottoms, the incandescent coke falls by its own weight into closed receptacles C beneath without being cooled by contact with the outer air. This coke serves to generate superheated steam, produced by the injection of water into vaporizing appliances D placed in the closed receptacles in the midst of the mass of coke. The steam escapes by two pipes screwed at one end into the lower part of the retort, and the other ending in a vertical opening made in the centre of blocks of refractory material supporting the retorts. By means of this opening, the superheated steam is conveyed directly into the retorts, and is there converted into water gas which mixes at a high temperature with the coal gas in course of production.

Referring to the illustrations, fig. 1 is a longitudinal vertical section of the setting and of the generators placed at either end; while fig. 2 is a transverse vertical section—the portion to the left being in the axis of a vertical retort, and that on the right in the axis between two retorts. The object of the double wall of the retorts is to allow the gas to reach the ascension-pipes, and from them to pass into the hydraulic main, without having to make its way through the charge of coal in process of carbonization; its course being through the perforations in the inner wall of the retort. The two walls are closed at the top by a mouthpiece E, into which the ascension-pipe F (fig. 2) enters. The combustion chambers G are heated by means of gaseous fuel produced in the vertical generators. It is in the former that the gaseous fuel meets the secondary air arriving in the opposite direction; and the resulting flames rise into all the spaces separating the retorts, surround the latter, and heat them uniformly. The closed receptacle under each vertical retort has at its lower extremity an opening by which the cold coke may be drawn out before a fresh charge of incandescent coke is allowed to fall into it.

In the setting of retorts devised by the inventor there are three different periods of distillation: (1) A period during which, until a temperature between 800° and 900° C. has been reached, only coal gas of good quality will be produced. (2) A period during which, by maintaining the temperature in the retorts above 700° C., by superheating them by means of generators, and by suitably regulating the injection of water, there will be produced, once or several times, a highly economical mixture of coal gas and water gas of good quality. (3) A period during which, by carbonizing coal at high temperature—*i.e.*, from 700° C. up to 1200° C.—a large quantity of coal gas will be obtained, but of a lower quality than that produced during the first period. The retorts are furnished with an automatic charger H which permits the rapid and simultaneous charging of all the retorts in a setting, irrespective of their number. This is claimed to be an entirely new feature in retort stoking. Before each fresh charging of the retorts, they must, of course, have been thoroughly emptied of the incandescent coke by causing it to fall into the receptacles already referred to. This is done by simultaneously drawing all the sliding bottoms of the retorts, which is effected by means of the mechanism shown at I in the diagrams.

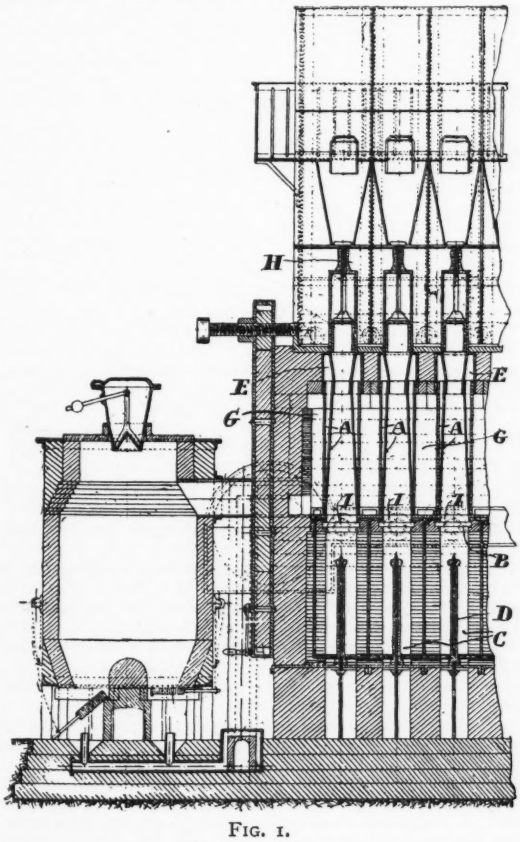


FIG. 1.

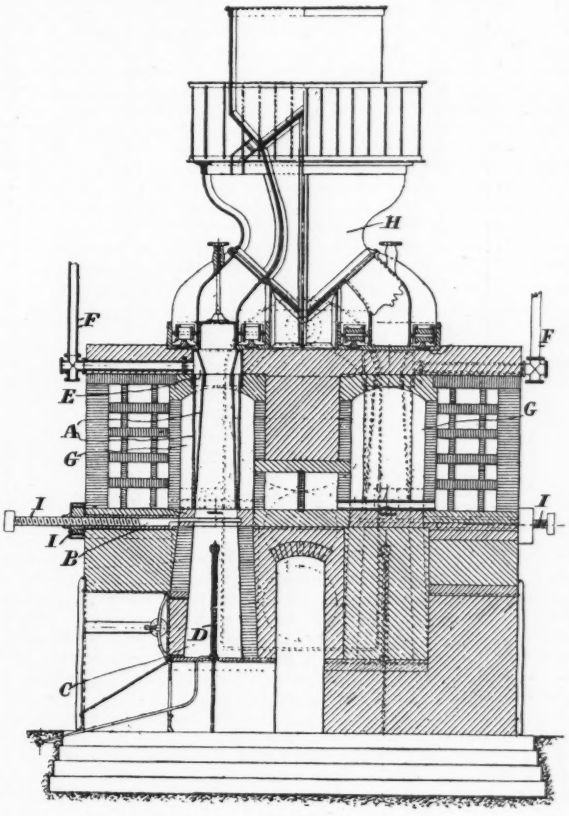


FIG. 2.

WILSON'S APPARATUS FOR THE ANALYSIS OF FLUE GASES.

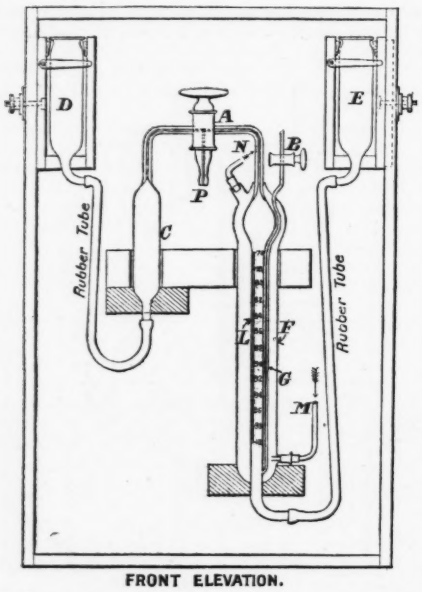
A VOLUME of the "Proceedings" of the Institution of Civil Engineers is not the most promising of authorities that one would take up for obtaining information on chemical subjects; but one which has lately been issued (Vol. CLXII.) contains a paper of such special interest to our readers that no apology need be offered for giving some extracts from it. In these days of generation, regeneration, and producer gas for heating, the gas engineer must be fairly well acquainted with the composition of the furnace gases at different parts of the apparatus, if he makes any pretention to rise above the convenient but erratic rule-of-thumb which still continues to do duty in many places, notwithstanding the march of education and enlightenment. Various forms of absorption apparatus have been placed at his disposal from time to time, starting from the well-known, but now obsolete, Cooper's tube, and passing through the various stages of refinement to Bunte's, Hempel's, or Orsat's apparatus, as now supplied by the leading makers of laboratory appliances, all of whom have for some time past listed various forms of them. Wilson's apparatus, as it is described in the paper referred to, offers a long step in the desirable direction of accuracy in results without sacrifice of time or a heavier demand on technical ability.

Time was when the civil engineer, even if engaged in such an essentially chemical department as the manufacture of illuminating gas, was inclined to regard laboratory operations as too theoretical and erratic to be of very great practical assistance,

and until a comparatively recent date he did not take much account of chemistry as a whole. In this connection, the appearance of a description of gas-analysis apparatus in the stronghold of civil engineering is notable, if for no other reason than that it affords a proof that the old state of things passes away, and that the civil engineer of the future will have a more intimate acquaintance with chemistry than his predecessors. Chemical engineering is already an established branch, and one that is rapidly widening and increasing in importance.

An apparatus for portable use should be as simple as possible, having no superfluous taps, bends, or lengths of capillary tubing. The line of demarcation between the gas and the confining fluid should be sharply distinct, and all parts of the apparatus (except that occupied by the gas or by the reagent) should be charged with the fluid. All parts of the interior should offer facility for washing out and cleansing. These considerations appear to have been fully recognized and provided for in the apparatus designed by Mr. Wilson, as shown in the accompanying illustration.

There is an eudiometer L, in which the gases are measured, connected by a capillary tube with a laboratory vessel C, in which the absorptions take place. Between L and C is a glass stopcock A, by means of which communication can be established either between L and C, or between either C or L and the point P. Both the eudiometer and the laboratory vessel are connected by india-rubber tubing with moveable mercury reservoirs D and E, the adjustment of which in a higher or lower position gives the necessary pressure for the transfer of gas or liquid in either direction. To ensure uniformity of temperature during an analysis, the eudiometer is water-jacketed; and as it would be difficult to adjust the vessel E so that the level of the mercury in it was precisely that of the mercury in the eudiometer, a comparison-tube G is provided. The eudiometer is



FRONT ELEVATION.

calibrated from the point where the capillary tube opens into it at the top to a mark at the bottom bearing the number 100. This space is 50 c.c.; but it is divided into 100 parts for convenience of directly reading off percentages by volume. The apparatus is filled with mercury, thus avoiding the liability to error which is experienced when water or a saline solution is used. The gas is measured in the eudiometer. The absorbents are drawn into the laboratory vessel, followed by the gas. After absorption has taken place, the gas is returned to the eudiometer for measurement; and the reagent is expelled at the point P. Emphasis is laid upon the fact that the apparatus, and the mercury, should be kept as clean as possible.

The right method of using the apparatus is as follows: Where a water supply is available, the inlet M is connected with the supply and the outlet N with the waste; but in the absence of a flow of water, M is plugged and the jacket is filled with water at N. After the entire system has been filled with mercury, the nozzle P is connected with the gas to be analyzed. The vessel E is lowered, and the tap A is turned to allow the gas to flow through P into the eudiometer until the level of the mercury is below the 100 mark. The tap A is then turned off. The tubing having been disconnected from P, the height of the vessel E is adjusted until the level of the mercury in the eudiometer is two divisions above the 100 mark. By pinching the rubber tube leading from E to the eudiometer, and momentarily opening the tap A, the excess of gas is allowed to escape. The tap A is turned so as to allow a little mercury to flow from C to L, and is then closed. The quantity of gas which was in the capillary tube between A and the top of the eudiometer having thus been driven over into the measuring vessel, which previously contained 99·6 volumes, will make up 100 volumes. The cock B is now opened, and the height of E adjusted until the levels of the two mercury columns in the eudiometer and the side tube G are exactly the same. If the operations have been performed properly, the eudiometer will now contain exactly 100 volumes. The precise point above the 100 mark at which the mercury must stand so that after the gas in the capillary tube at the top has been driven over 100 volumes may result, must always be found by trial, as the capacity of the tube may vary slightly in different apparatus.

To make an absorption, a small beaker containing the absorbing liquid is placed under P, the mercury-reservoir D is lowered, and the stopcock A is turned so as to draw the required quantity of liquid into the laboratory vessel C. When the desired quantity has been admitted, A is closed. The stopcock B is then closed, the mercury-reservoir E is raised, and the cock A is turned so as to allow the gas to pass from L to C, followed by a small quantity of mercury. By closing the tap A, and raising the mercury-reservoir D, the gas in the laboratory vessel C is compressed; and when the absorption is complete, the mercury-reservoir E is lowered, and the cock A is opened carefully to permit the gas to return to the eudiometer. When the absorbing liquid reaches the capillary tube leading from the laboratory vessel C, the flow must be carefully regulated; and the tap A must be turned off as soon as the liquid has just reached the point where the capillary tube joins the stopcock. The cock A is then turned to allow the rest of the liquid to flow out from P into a beaker placed for its reception. By lowering the mercury-reservoir D, a small quantity of clean water is drawn in, to wash the mercury in the laboratory vessel. This water is driven out again, and a small quantity of mercury is sent over from the laboratory vessel to the eudiometer, to fill the capillary tubes. By opening the stopcock B, the levels are adjusted as before; and the reading is then taken.

As to the determination of carbonic acid, a small quantity of a fairly strong solution of caustic potash will effect the complete absorption of the carbonic acid in a few minutes. For the determination of oxygen, a small quantity of pyrogallic acid solution is introduced into the laboratory vessel, followed by sufficient potash solution to make it strongly alkaline. The absorption can be hastened somewhat by moving the mercury-vessel D up and down. When the absorption is thought to be complete, and the gas has been transferred to the eudiometer, the laboratory vessel is washed out with water, and the gas is tested with a small quantity of fresh pyrogallic acid and potash mixture. Any trace of oxygen left will at once become evident by its blackening action on the reagent. With reference to the determination of carbonic oxide, this gas can be absorbed by means of a solution of cuprous chloride in ammonia. After the completion of the absorption, the laboratory vessel should be washed out with some weak ammonia solution, then a small quantity of dilute sulphuric acid solution drawn into it, and the gas returned and left in contact for a few minutes, in order to free it from ammonia vapour, before measurement.

At the end of each analysis, the laboratory vessel and the eudiometer should both be washed out with dilute acid.

Russian Gas Supply in Present-Day Times.—It is reported by the daily papers that, in organizing the great struggle now going on in Russia, it was arranged that the gas-works in the various cities and towns were to be excluded from the operation of the strike, owing to the danger that meters and pipes might freeze and burst. So far no news of any serious damage has been received.

Laying Concrete under Water.—A cut-stone granite masonry dock is under construction at New Rochelle (N.Y.), at the corner of a park in the immediate vicinity of the houses of several yacht clubs. The rock foundation on which the dock is built lies at a depth of 14 to 19 feet below the mean low tide, and is covered with varying depths of mud. The granite masonry is on a concrete footing which extends from the rock to within a foot of the mean low tide, and has a batter of 1 to 4 on both faces, except where it is on a shelf made in the rock where the latter is sloping transversely to the line of the dock. According to the "Engineering Record," the construction work is carried on in an interesting manner, the concrete of the footing being laid loose under water with the assistance of a diver. The mud was first stripped from the rock with a dipper dredge, and the surface of the foundation washed clean by the diver with a hydraulic jet under considerable pressure. The rock has in it deep irregular surface fissures filled with mud, which were difficult to clean out, but which serve to key the footing firmly to the foundation. The concrete is placed in forms built up from the rock the length of the dock on the front face of the footing, and, where necessary, on the rear face. The faces of the forms are 2 in. by 10 in. plank nailed longitudinally to 2 in. by 10 in. verticals. A box is made on the outside of the form by nailing a horizontal plank on to the bottom, and then a second vertical row of longitudinal 2 in. by 10 in. planks on the outside of the verticals. This box is filled with enough broken stone to hold the form firmly on the bottom. The forms are made in sections 16 feet long, and the sections are anchored by wire cables near the bottom to the piles of an old dock inside the line of the new one. They are also braced in position at the top by cross pieces nailed to the stringers of the old dock. No attempt is made to level the surface of the rock foundation, and where the forms do not rest evenly on it, bags of concrete are filled by the diver in the space between the bottom of the form and the rock.

OBITUARY.

CHARLES REVILL BELLAMY.

It is with much regret that we record the rather sudden death, on the 23rd ult., of Mr. Charles Revill Bellamy, the City Lighting Engineer of Liverpool, and the General Manager of the Electric Tramways Department of the Corporation. Deceased sprained his ankle and hurt his leg through a fall in the basement of his residence on the 12th ult. His injuries were duly attended to by a medical man, and he appeared to be going on fairly well. On the night of Saturday week, however, he became seriously ill, and died a few minutes after the arrival of the doctor who had been summoned. At the Coroner's inquest last Tuesday, the medical evidence was to the effect that death was due to the clotting of the large artery leading from the heart to the lungs, accelerated by the injury to the leg; and a verdict of "Accidental death" was returned.

According to a recent number of the "Liverpool Guild Gazette," which contained an account of Mr. Bellamy's career, accompanied by a portrait, he was a native of London, and received his early professional training with the South Metropolitan Gas Company. In 1877, he was appointed Assistant at the Norwich station of the British Gaslight Company. He had seen nearly a quarter-of-a-century of service under the Liverpool Corporation, having been appointed in March, 1882, as Assistant Gas and Meter Inspector, succeeding Mr. H. Ashton Hill, who obtained the position of Gas and Water Engineer to the Wallasey Local Board. In 1894, the Lighting Committee appointed Mr. Bellamy as Superintendent of the Lighting Department, and in October, 1895, made him City Lighting Engineer under the newly-constituted Lighting Committee, the title covering the offices of lighting superintendent, gas inspector, gas-meter inspector, gas examiner, and electric-meter inspector. Under his able supervision and untiring zeal, Liverpool became one of the best-lighted cities in the United Kingdom. In 1893, the length of lighted streets was 272½ miles, and there were in use 11,122 lamps, having an aggregate illuminating power of 771 million candles; the total charges being £40,881. At the present time, the length of the streets lighted has increased to 441¼ miles, the total number of lamps to 18,360, and the aggregate illuminating power to 3273 million candles; the total charges being £47,648. It will thus be seen that while 168¾ miles of street lighting have been added, increasing the number of lamps by 65 per cent., and the aggregate illuminating power has been more than quadrupled, the charges are only 16 per cent. greater than they were in 1893. A more direct comparison is shown by the figures applicable to the old city, which last year had 275¼ miles of streets lighted with 13,111 lamps, having an aggregate illuminating power of 2406 million candles; the total management charges being £35,267. So that while one mile of street lighting has been added in the old city since 1893, with 1989 additional lamps, and the total illuminating power more than trebled, the charge has fallen by £5614, or 13 per cent. The system of incandescent gas lighting introduced, on the report of Mr. Bellamy, in 1894 resulted in a saving of £7000. In addition, the Lighting Committee were enabled to save a further £2500 per annum in obtaining a standing discount of 10 per cent. on the Gas Company's accounts for the supply of gas to the public lamps; making a total reduction of £9500. The Committee decided to apply the greater portion of this sum to the improvement of the lighting of the city; and, as our columns have shown, schemes for reducing the distance between the lamps, passage lighting, electric lighting, and incandescent gas lighting were adopted.

Of Mr. Bellamy's work in connection with the Tramways Department it is only necessary to say here that it was marked by great success. He was one of the leading lights in the tramway world. In 1903, he was called upon by the New York Reform Club Committee on City Affairs to attend the National Convention on Municipal Ownership and Public Franchises in New York, at which he contributed a valuable paper on the subject in question. He was an associate member of the Institution of Civil Engineers, a Past-President and member of the Council of the Municipal Tramways Association of Great Britain, Vice-President and President-Elect of the Tramways and Light Railways Association, and a member of the Liverpool Engineering Society. He took a keen interest in the welfare of the employees in his department; and by his exertions the Social, Athletic, and Thrift Society was founded. He was full of genial and sympathetic thought for his colleagues and others associated with the tramways.

At the close of a distribution of funds by the Mayor on Christmas Eve, his Worship referred in a feeling manner to the loss the city had sustained by the death of Mr. Bellamy, whom he characterized as "a public official of unique ability and inestimable worth." He said he was a gentleman for whom he entertained the highest possible feeling of admiration as a servant of the Corporation and the public, both in his capacity as the General Manager of the tramways and as the City Lighting Engineer. Beyond this, he had a profound regard for his splendid personal qualities. At the inquest also the Coroner expressed sincere sympathy with the bereaved family; and, in paying a tribute to the ability and courtesy of Mr. Bellamy, he said it would be very hard to fill his place. His death was a great loss to the city. At meetings of the Tramways and Lighting Committees of the Corporation on Friday, the valuable services of Mr. Bellamy were referred to, and votes of condolence were passed with Mrs. Bellamy and the family in their severe bereavement.

The funeral took place on Wednesday, at Kirkdale Cemetery, Walton, and was attended by a large concourse.

The death is recorded of Alderman J. Flintham, J.P., who was Chairman for many years of the Aldeburgh Gas Company, Limited, and only quite recently sold out his interest in the concern. He was also in 1877 elected a Director of the Aldeburgh Water Company, and, becoming Chairman in 1890, took an active part in the management of the undertaking until it was sold to the Corporation a few years since.

We regret to record the death, on the 29th ult., of Dr. T. Rutherford Adams, one of the Directors of the Croydon Gas Company. He was elected a member of the Board in 1894; and had always taken a keen interest in the affairs of the Company. He was a very old resident in Croydon, of which he was a Justice of the Peace, and was highly esteemed. He was in his 68th year at the time of his death, the cause of which was peritonitis.

PERSONAL.

Mr. Charles Hunt has been chosen to fill a vacancy on the Board of the Bombay Gas Company, Limited, caused by the death of Major Gordon, who was the oldest Director, and had been associated with the Company almost from its commencement.

In the "Journal" for the 20th of June last, we announced the resignation by Mr. Ernest Heald of the secretaryship of the River Plate Gas Company, Limited, and the appointment of Mr. Henry T. Adkins as Acting-Secretary. Mr. Adkins has now been definitely appointed Secretary of the Company.

Many of our readers will doubtless have shared with us the pleasure of reading the announcement last Saturday of the elevation of Sir James Joicey, Bart., M.P., to the peerage. As Chairman and Managing-Director of James Joicey and Co., Limited, and the Lambton Collieries, Limited—the two largest colliery companies in the county of Durham—the new peer is necessarily in close touch with the gas industry; and his business and personal qualities are known to not a few of the principal officials connected with gas undertakings. The honour conferred upon him therefore claims notice in these columns. In addition to the above-named positions, Sir James is a Director of the North-Eastern Railway Company, and the owner of the Ulgham Estate in Northumberland, consisting of a village and several farms, which he purchased from the Earl of Carlisle. He represents the Chester-le-Street Division of Durham, and at the last election was returned by a majority of 439 over the Conservative candidate (Captain Nicholson). He is a Deputy-Lieutenant of the County of Durham, and was awarded a baronetcy in 1893.

Electrolysis of Gas and Water Pipes.

Our contemporary "Engineering Record" points out that the above subject is now being brought to the forefront of topics of current technical interest by some of those who until recently have treated it as too trivial to deserve attention. The street railway and electrical journals have heretofore followed the lead of the electric supply people in refusing to attribute much significance to the electrolysis of underground conductors, and have even exceeded the manufacturers of car equipments in their expressions of contempt for publications that have asked for a fair deal for gas and water companies. These editorial partisans must consequently feel extremely uncomfortable at the predicament in which they are left by the recent rejection of their cherished views by the Westinghouse engineers. For example, in the last number of the "Electric Journal," Mr. P. M. Lincoln says: "This matter of electrolysis is admittedly one of the most serious that the operators of the direct-current traction system are confronted with—first, because of the difficulty in applying any remedy in the universally used rail-return system; and, secondly, because of the insidious character of the evil, immense damage may be done before it is realized that any remedy is needed. . . . Evidently there are two ways of preventing electrolysis—first, by keeping all current out of the ground, which is impossible with the rail-return system; secondly, by making innocuous the currents that flow in the ground. Tests by Mr. Kintner indicate that a ready method of accomplishing this result is to make the currents alternating." Our contemporary says that more than this was never claimed by the most ardent advocate of fair treatment for the owners of the gas, water, and telephone conduits, which are being ruined by the wandering currents from street railways.

Gas-Engines for Working an Elevated Railway.—We learn from "Engineering Record" that two gas-engine stations are to be built by the Boston Elevated Railway Company in order to test practically the operation of these plants in railway service. At Medford, a 1500-horse power producer-gas plant and three 500-horse power Körting gas-engines, direct-connected to Crocker-Wheeler generators, will be installed. At West Somerville, the Power and Mining Machinery Company will put in two Loomis-Pettibone generators, with accessory apparatus, and two American Crossley gas-engines, each rated at 600-horse power, connected direct to Crocker-Wheeler generators.

THE NEW INSTRUCTIONS OF THE METROPOLITAN GAS REFEREES.

Many Important Changes.

As it is now more than seven years since any considerable alteration was made in the instructions of the Metropolitan Gas Referees, and as, in the interval, the conditions of gas supply in London have undergone changes which have necessitated material modifications, we give, practically in full, the notification which the Referees have issued for the current year.

The opening paragraph sets forth, as before, the various Acts under which the Referees exercise their powers, and defines their duties, one of which is to prescribe and certify the places at which the gas is to be tested. A list of these (fourteen for the Gaslight and Coke Company, two for the Commercial Cas Company, and six for the South Metropolitan Gas Company) is given; and then the specific instructions follow.

Service-Pipes to the Testing-Places.

The conditions to be observed in connecting the Gas Companies' mains with the apparatus in the testing-places and in providing for shutting off the gas in case of emergency are prescribed by section 8 of the London Gas Act, 1905. If obstruction of the service-pipe is found, or if there is reason to think that the quality of the gas is suffering from any change occurring within the service-pipe, the pipe may be washed out in the presence of, and by arrangement with, the Gas Examiner, either with hot water alone or with any usual solvent—such as benzol, naphtha, or petroleum. But the use of such solvents is to be followed by a washing with hot water. In every case where the service-pipe is washed out, the Gas Company shall send a letter to the Gas Referees, explaining why the washing was considered necessary. The Gas Companies may, if they think fit, provide a tap and funnel in any testing-place for the purpose of such washing out. No testing for illuminating power is to be made until after the lapse of an hour since the last washing out.

Standard Lamp to be Used for Testing Illuminating Power.

The standard to be used in testing the illuminating power of gas shall be a pentane 10-candle lamp which has been examined and certified by the Gas Referees. A description of the lamp is given in Appendix A. The residue of pentane in the saturator shall, at least once in each calendar month, be removed, and shall not be used again in any testings. The pentane to be used in the lamp is to be prepared as described in Appendix B, and it is to show when tested the properties there specified. All pentane provided by the Gas Companies will be examined and certified by the Referees, and will be sent to the testing-places in cans which have been both sealed and labelled by them; and no pentane is to be used in the testing-places other than that which has been thus certified. The procedure to be followed in the issue of pentane to the testing-places is described in Appendix C.

Times and Mode of Testing for Illuminating Power.

I.—Testings with the Metropolitan Argand Burner No. 2.

The testings for illuminating power made with the standard argand shall be three in number daily. "The tests for illuminating power shall be taken at intervals of not less than one hour." "The average of all the testings at any testing-place on each day of the illuminating power of the gas supplied by the Company at such testing-place shall be deemed to represent the illuminating power of such gas on that day at such testing-place." [Gaslight and Coke and other Gas Companies' Acts Amendment Act, 1880, sections 7 and 8.]

But "if on any one day the gas supplied by the Company at any testing-place is of less illuminating power, to an extent not exceeding one candle, than it ought to be, the average of all the testings made at such testing-place on that day and on the preceding day and on the following day shall be deemed to represent the illuminating power of the gas on such one day at such testing-place." [London Gas Act, 1905, section 4 (3).]

The photometer to be used in the testing-places shall be the table photometer described in Appendix D. The air gas in the lamp is to be kept burning so that the flame is near its proper height for at least ten minutes before any testing is made. At the completion of every testing, the air gas is to be turned off; but if the interval between two testings does not much exceed one hour, and the Gas Examiner is present during the interval, he may, instead of turning it off completely, turn it down low.

The argand burner attached to each photometer shall be a standard burner called the "Metropolitan argand burner No. 2," which has been devised by Mr. Charles Carpenter. A description of the burner is given in Appendix E. No argand burner shall be used for testing the illuminating power of gas that does not bear the lead seal of the Gas Referees.

A clean chimney is to be placed on the burner before each testing; and care should be taken that the glass does not become dimmed by the smoking of the flame.

The gas under examination is to be kept burning, so that the flame is about the usual height, for at least 15 minutes before any testing is made. The damper shall be kept down during this interval. No gas shall pass through the meter attached to the photometer except that which is consumed in testing or during the intervals between the testings made on any day, and that which is used in proving the meter.

The paper used in the photoped of the photometer shall be white in colour, unglazed, of fine grain, and free from water marks. It shall be as translucent as is possible consistently with its being sufficiently opaque to prevent any change in the apparent relative brightness of the two portions of the illuminated surface when the head is moved to either side. The paper should, when not in use, be covered to protect it from dust; and if it has been in any way marked or soiled, a fresh piece is to be substituted.

Each testing shall be made as follows: The index of the regulating-tap shall be so adjusted that the meter-hand makes one complete revolution in not less than 59 or more than 61 seconds. The damper for regulating the air supply to the burner shall be screwed upwards until a sensitive point is reached at which the flame begins to tail up rapidly above the chimney; it shall then immediately be screwed back half-a-turn, as judged by the position of the projecting pointer attached to the damper. The connecting-rod shall now be pushed to and fro by the Gas Examiner until the illumination of the photoped by the two sources of light is judged to be equal. A balance is best attained by making small alterations of decreasing amplitude rather than by a very slow movement in one direction only. The reading on the photometric scale shall be noted. This observation is to be made four times in all, and the mean of the results taken. The time that the meter-hand takes to make exactly two revolutions shall then be observed by the aid of a stop-clock or stop-watch. The mean of the four readings of the photometric scale shall be multipled by the number of seconds in the time recorded and by the aerorthometer reading and divided by 120. The quotient is the illuminating power.

If the gas is so rich that it cannot be made to burn at the prescribed rate without tailing above the chimney or smoking, or if the burner cannot be pushed far enough away to produce equality of illumination on the photoped, the rate must be reduced until the flame burns properly within the chimney, or a balance is produced when the burner is at the far end of the slide. In all other respects, testing and calculation shall be made as described.

If, in very exceptional circumstances, the aerorthometer scale or the table does not include the conditions that are met with, the Gas Examiner shall, in calculating the illuminating power, use the formula printed below the table.

Each testing-place must be provided with a standard clock that will go for a week without re-winding.

The Gas Examiner shall, at least once a week, compare the stop-clock in the testing-place with the standard clock or with his watch.

The Gas Examiner shall enter in his book the particulars of every testing of illuminating power made by him at the testing-places, during or immediately after such testing; and in the case of any testing which he rejects, he shall also state the cause of rejection. No testing is to be rejected on the ground that the result seems improbable.

II.—Testings with the Standard Flat-Flame Burner.

The testings for illuminating power made with the flat-flame burner shall be made at such times as the controlling authority shall direct. The burner shall be Bray's "No. 7 Economizer" fitted over a Bray's "No. 4 Regulator," as described in Appendix D. The testings made with it shall be conducted in the same way as those with the argand. A new burner shall be used every month. If the gas is so poor that the burner cannot be brought near enough to produce equality of illumination on the photoped, the rate of consumption must be increased until a balance is produced when the burner is at the near end of the slide. In all other respects, the testing shall be carried out as described.

Times and Mode of Testing for Sulphuretted Hydrogen.

The apparatus to be used in testing gas for the presence of sulphuretted hydrogen is figured in Appendix H. The gas as it leaves the service-pipe shall be passed through the glass vessel in which are suspended slips of bibulous paper which have been recently moistened by dipping them in a solution consisting of 100 grains of crystallized acetate of lead dissolved in 100 cubic centimetres of water.

One testing shall be made daily. In making the test, gas shall be turned on to the apparatus and lit at the burner as soon as the air has been swept out. When the gas has burnt for three minutes, it is to be turned off, and one of the slips of paper is to be compared with another similar slip which has not been exposed to the gas. The gas is to be taken as showing the presence of sulphuretted hydrogen if the slip of paper which has been exposed to it is unmistakably the darker of the two.

In this event, two of the test-slips shall be placed in a stoppered bottle, and kept in the dark at the testing-place. One of the remaining slips shall be forwarded with each daily report, and the comparison slip shall be retained by the Gas Examiner for the use of the Chief Gas Examiner.

The Gas Examiner in making his return shall write either "present" or "absent" as the case may be.

Testing for Sulphur Compounds other than Sulphuretted Hydrogen.

This testing shall be made on such days as the controlling authority shall direct. A description of the apparatus to be employed is given in Appendix K. It is to be set up in a room or closet where no other gas is burning. The gas shall pass through a meter by reference to which the rate of flow can be adjusted, and which is provided with a self-acting movement for shutting off the gas when 10 cubic feet have passed.

Pieces of sesquicarbonate of ammonia, from the surface of which any efflorescence has been removed, are to be placed round the stem of the burner. The index of the meter is to be then turned forward to the point at which the catch falls and will again support the lever-tap in the horizontal position. The lever is made to rest against the catch so as to turn on the gas. The index is turned back to a little short of zero, and the burner lighted. When the index is close to zero, the trumpet-tube is placed in position on the stand, and its narrow end connected with the tubulure of the condenser. At the same time, the long chimney-tube is attached to the top of the condenser.

As soon as the testing has been started, a first reading of the aerorthometer is to be made and recorded, and a second reading as near as may be to the time at which the gas is shut off. The rate of burning, which with practice can be judged very nearly by the height of the flame, is to be adjusted by timing the index of the meter to about half a cubic foot of gas per hour.

After each testing, the flask or beaker, which has received the liquid products of the combustion of the 10 cubic feet of gas, is to be emptied into a measuring cylinder, and then replaced to receive the washings of the condenser. Next the trumpet-tube is to be removed and well washed out into the measuring cylinder. The condenser is then to be flushed twice or thrice by pouring quickly into the mouth of it 40 or 50 cc. of distilled water. These washings are brought into the measuring cylinder, whose contents are to be well mixed and divided into two equal parts.

One-half of the liquid so obtained is to be set aside, in case it should be desirable to repeat the determination of the amount of sulphur which the liquid contains. The other half of the liquid is to be brought into a flask or beaker covered with a large watch-glass, treated with hydrochloric acid sufficient in quantity to leave an excess of acid in the solution, and then raised to the boiling-point. An excess of a solution of barium chloride in now to be added, and the boiling continued for five minutes. The vessel and its contents are to be allowed to stand till the barium sulphate has settled at the bottom of the vessel, after which the clear liquid is to be as far as possible poured off through a paper filter. The remaining liquid and barium sulphate are then to be brought on to the filter, and the latter is to be well washed with hot distilled water. [In order to ascertain whether every trace of barium chloride and ammonium chloride has been removed, a small quantity of the washings from the filter should be placed in a test-tube, and a drop of a solution of silver nitrate added. Should the liquid, instead of remaining perfectly clear, become cloudy, the washing must be continued until, on repeating the test, no cloudiness is produced.] Dry the filter with its contents, and transfer it into a weighed platinum crucible. Heat the crucible over a lamp, increasing the temperature gradually, from the point at which the paper begins to char, up to bright redness.* When no black particles remain, allow the crucible to cool, place it when nearly cold in a desiccator over strong sulphuric acid, and again weigh it. The difference between the first and second weighings of the crucible will give the number of grains of barium sulphate. Multiply this number by 11 and divide by 4; the result is the number of grains of sulphur in 100 cubic feet of gas. This number is to be corrected for the variations of temperature and atmospheric pressure in the manner indicated under the head of "Illuminating Power," with this difference, that the mean of the first and second aerorthometer readings shall be taken as the reading. The correction by means of the aerorthometer reading may be made most simply and with sufficient accuracy in the following manner.

When the aerorthometer reading is between ·955-·965, ·965-·975, ·975-·985, ·985-·995, diminish the number of grains of sulphur by 4, 3, 2, and 1 per cent. respectively.

When the aerorthometer reading is between ·995-1·005, no correction need be made.

When the aerorthometer reading is between 1·005-1·015, 1·015-1·025, 1·025-1·035, increase the number of grains of sulphur by 1, 2, and 3 per cent. respectively.

Example:

Grains of barium sulphate from 5 cub. ft. of gas	10·4	Aerorthometer reading 1·018
Multiply by 11 and divide by 4	11	
	4)114·4	
Grains of sulphur in 100 cub. ft. of gas (uncorrected)	28·60	
Add 28·6 × 100 =	0·57	
Grains of sulphur in 100 cub. ft. of gas (corrected)	29·17	Result: 29·2 grains.

The aerorthometer reading is the reciprocal of the tabular number. The Gas Examiner shall, not less often than once a month, compare the aerorthometer reading with the reciprocal of the tabular number deduced from observations of the barometer and thermometer, and if there is a difference of more than ½ per cent., the aerorthometer is to be re-adjusted.

* An equally good and more expeditious method is to drop the filter with its contents, drained but not dried, into the red-hot crucible.

Testing the Calorific Power of the Gas.

This testing shall be made on such days as the controlling authority shall direct.

The calorimeter to be used in testing the calorific power of the gas shall be one which has been examined and certified by the Gas Referees. A description of the calorimeter is given in Appendix L.

In order to test the gas for calorific power, the gas shall first pass through a meter and a balance governor of the same construction as those on the photometer table. It shall then be led to the gas-inlet in the base of the calorimeter. The gas shall be turned on and lighted, and the tap of the calorimeter shall be so adjusted as to allow the meter-hand to make one turn in from 60 to 75 seconds. The water shall be turned on so that when the regular flow through the calorimeter has been established, a little may pass the overflow of the funnel and trickle over into the sink. The calorimeter must then be placed upon its base, and some water poured in through one of the holes in the lid until it begins to run out at the condensation outlet. After an interval of not less than 20 minutes, the Gas Examiner shall bring the reading-glasses into position on the thermometers used for measuring the temperature of the inlet and outlet water. He shall place the measuring vessel carrrying the change-over funnel shown in figs. 8 and 10, in position in the sink, so that the outlet water is led into the sink. The hot-water outlet-tube of the calorimeter should be above, but should not touch, the change-over funnel. He shall then make the following observations: When the meter-hand is at 75, he shall read the inlet temperature; when it reaches 100, he shall move the funnel so as to direct the overflow into the measuring vessel, and at the same time he shall start the stop-clock or a stop-watch. When the meter-hand reaches 25, he shall make the first reading of the outlet temperature. He shall continue to read the outlet temperature at every quarter-turn until 15 readings have been taken. The meter-hand will then be at 75. He shall also at every turn of the meter, except the last, make a reading of the inlet temperature when the meter-hand is between 75 and 100. When the meter-hand reaches 100 after the last outlet temperature has been read, the Gas Examiner shall shift the funnel so as to direct the outlet water into the sink again, and at the same time stop the clock or watch. The barometer and the thermometers showing the temperatures of the effluent gas, of the air near the calorimeter, and of the gas in the meter, shall then be read. The time shown by the stop-clock shall be recorded. The mean of the four readings of the inlet temperature is to be subtracted from the mean of the 15 readings of the outlet temperature, and the difference is to be multiplied by 3 and by the number of litres of water collected, and the product divided by the tabular number. The difference in degrees Centigrade of the temperature of the effluent gas and of the surrounding air shall be taken, and one-third of this difference shall be added to the result previously found, if the effluent gas is the warmer of the two, or subtracted if the effluent gas is the cooler of the two.* The result is the gross calorific power of the gas in calories per cubic foot.

In addition to the observations described, the amount of condensed water resulting from the combustion of the gas shall be measured. For this purpose a measuring cylinder of 50 cubic centimetres capacity shall be placed under the dripping-tube not less than 10 minutes after the calorimeter has been placed in position and overcharged with water. The amount collected in not less than 15 minutes shall be measured; the time of collection having been accurately noted.

The number of cubic centimetres collected shall be multiplied by the number of seconds in the time indicated by the stop-clock and by the number 1·86. The number of seconds in the time during which the condensed water was being collected shall be multiplied by the tabular number. The first product shall be divided by the second. The quotient is to be subtracted from the gross calorific power. The difference is the net calorific power in calories per cubic foot. The corresponding values of the gross and net calorific power in British thermal units can be obtained by multiplying the number of calories by 3·968.

A form on which the Gas Examiner may conveniently set down his observations and the whole of the figures needed for the calculation is given at the end of Appendix L. The figures in italic type are specimen figures, and represent such as might be written by the Gas Examiner. Those in ordinary type and all decimal points should be printed upon the form.

Testing the Pressure at which Gas is Supplied.

Testings of pressure shall be made at such times and in such places as the controlling authority may from time to time appoint (Gaslight and Coke and other Gas Companies' Acts Amendment Act, 1880, section 6). In order to make this testing, the Gas Examiner shall unscrew the governor and burner of one of the ordinary public lamps, and shall attach in their stead a portable pressure-gauge. In places where incandescent burners are used for street lighting, one street-lamp

* This correction depends upon the proportion of air to gas which the construction of the instrument determines.

in each street or group of streets may be provided under the lantern with a branch closed by a screw stopper. The Gas Examiner shall in such cases connect the pressure-gauge by screwing to it an L-shaped pipe fitted with a union, by means of which it may be connected to the service-pipe in the place of the screw stopper. The L-shaped pipe is to be of such dimensions as to enable the pressure-gauge to be fixed outside the lantern, but at about the same level as the incandescent burner. It should be provided with a tap.

The gauge to be used for this purpose consists of an ordinary pressure-gauge enclosed in a lantern, which also holds a candle for throwing light upon the tubes and scale. The difference of level of the water in the two limbs of the gauge is read by means of a sliding-scale, the zero of which is made to coincide with the top of the lower column of liquid.

The Gas Examiner having fixed the gauge gas-tight, and as nearly as possible vertical on the pipe of the lamp, and having opened the cocks of the lamp and gauge, shall read and at once record the pressure shown. From the observed pressure, one-tenth of an inch is to be deducted to correct for the difference between the pressure of gas at the top of the lamp-column and that at which it is supplied to the basement of neighbouring houses.

The pressure prescribed in the Acts of the three Metropolitan Gas Companies is to be such as to balance from midnight to sunset a column of water not less than 6-10ths of an inch in height, and to balance from sunset to midnight a column of water not less than one inch in height.

Meters.

Each of the meters used for measuring the gas consumed in making the various testings is constructed with a measuring drum which allows 1-12th of a cubic foot of gas to pass for every revolution. A hand is fastened directly to the axle of this drum, and passes over a dial divided into 100 equal divisions. The dial and hand are protected by a glass. In the meter employed in testing the purity of gas, the pattern of dial for showing the number of revolutions and the automatic cut-off hitherto in use shall be retained; but in the meter employed for testing illuminating power, only the dial above described is needed. The meters should be provided with Fahrenheit thermometers. The stop-clock may be either attached to the meter or be separate.

The meters used for measuring the gas consumed in making the various testings having been certified by the Referees, shall, at least once in seven days, be proved by the Gas Examiners by means of the Referees' 1-12th of a cubic foot measure.

No meter other than a wet meter shall be used in testing the gas under these instructions.

The results of the testings for illuminating power, calorific power, purity, and pressure shall be recorded and delivered as provided in section 11 of the Gaslight and Coke and other Gas Companies' Acts Amendment Act, 1880, and in section 5 (2) of the London Gas Act, 1905.

These regulations shall be in force from Jan. 1, 1906, until they are superseded by a subsequent notification.

C. V. Boys,
J. S. Haldane,
A. Vernon Harcourt,
Gas Referees.

APPENDIX A.

The Ten-Candle Pentane Lamp.

The description of this part of the testing plant has not been materially altered since 1898; and readers are referred to the illustration of the lamp and directions for its use which appeared in the "Journal" for May 31, 1898, pp. 1254-55.

APPENDICES B AND C.

The Preparation and Use of Pentane.

The first of these is a reproduction of the earlier account of the prescribed method for the preparation and testing of the pentane to be used in the 10-candle lamp. [See "Journal" for May 31, 1898, p. 1255.] Appendix C deals with the provision of pentane for use in the testing-places; also its certification by the Referees as being of the proper quality.

APPENDIX D.*

The Table Photometer.

The several parts of this apparatus stand upon a well-made and firm table, 5 ft. 6 in. by 3 ft. 6 in. and 2 ft. 5 in high. The upper surface of the table is smooth, level, and dead-black. Upon this are placed or clamped, in the position shown in fig. 1: (1) The gas-meter; (2) the gas-governor; (3) the regulating tap; (4) the "Metropolitan argand burner, No. 2," and sliding base; (5) the flat-flame burner and sliding base; (6) the slide, connecting rod and photometric scale, and index; (7) the connecting pipes; (8) the pentane ten-candle lamp; (9) the photoped; (10) the aerorthometer; (11) the stop-clock; (12) dark screens, mirrors, measuring rod, small block and pulley.

* As many changes have been made in this appendix, it is given, practically speaking, in its entirety.

(1).—*The Gas-Meter.*

The gas-meter is sufficiently described in the notification itself.

(2).—*The Gas-Governor.*

The gas-governor must be such as will effectually do away with any variation of pressure produced by the working of the meter or other causes. A loose blackened screen, 8½ in. high by 6 in. wide, should be placed upon the base of the governor, near the tank, to prevent the water in the tank being heated by the flame of the gas-burner.

(3).—*The Regulating Tap.*

This must have a large, well-fitting, conical plug, with a round hole on each side, of such a size as to allow gas to pass at the rate of about 4 cubic feet per hour, under the pressure at the outlet of the governor. In addition there must be narrow saw-cuts on opposite sides of the two holes when viewed in plan, which will allow an additional passage of about 2 cubic feet of gas per hour when the tap is so turned that the holes and the saw-cuts are both opposite the orifices of the fixed part of the tap. The index must be secured to the conical plug without any play; and its pointed end must pass over a scale graduated in degrees upon an arc of not less than 80 mm. radius. The arc is to extend over 90°, and the degrees are to be numbered from 0° to 90°. The arc is to be made of white enamel glass; and the

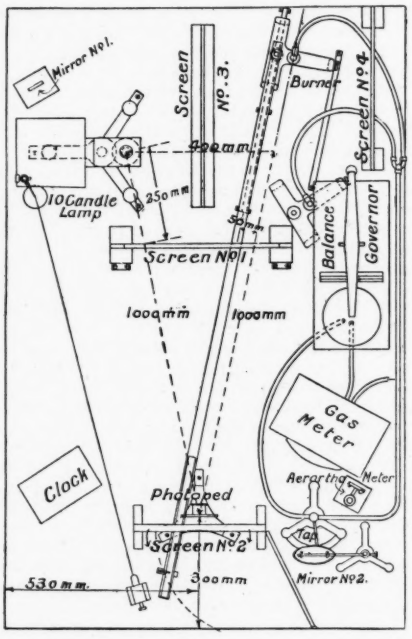


FIG. 1.

divisions are to be etched upon it, and the marks filled in with black. The tap is to be off when the pointer is at one extremity of the arc at 0°, and fully on when it is at the other extremity at 90°. The small hole should be fully open at about 20°, so that the action of the saw-cuts may extend over the remaining portion of the arc. The tap must be kept clean and sufficiently lubricated to work easily.

(4).—*The "Metropolitan Argand Burner, No. 2."*

This is the burner described in Appendix E. It is to be mounted upon a tripod capable of moving upon the slides fixed to the table, so that its distance from the photoped can be adjusted by means of the connecting rod. The construction of the cast-iron foot and slide is shown in fig. 2. The height of the top of the cone is 353 mm. above the table. The axis of the burner should be vertical.

(5.)—*The Flat-Flame Burner.*

The flat-flame burner is Bray's "No. 7 Economizer" fitted over a Bray's "No. 4 Regulator." The No. 7 economizer is a slit-burner, the width of the slit being 0·024 inch. The No. 4 regulator is a union-jet burner. Both the economizer and burner contain gauze to steady the flow of gas. The burner is carried upon a sliding foot of the same construction as that used for the Metropolitan argand burner, No. 2. An adapter is used to bring the height of the top of the burner to 353 mm. above the table; and the burner is so turned that the plane of the flame makes an angle of about 45° with the line joining it and the slit in front of the photoped. When the argand is being used, the sliding foot carrying the flat-flame burner may be made to stand out of the

way as shown in fig. 1. When the flat-flame burner is being used, the sliding foot carrying it is placed upon the slide, and the argand is pushed back as far as it will go, or, if necessary, it may

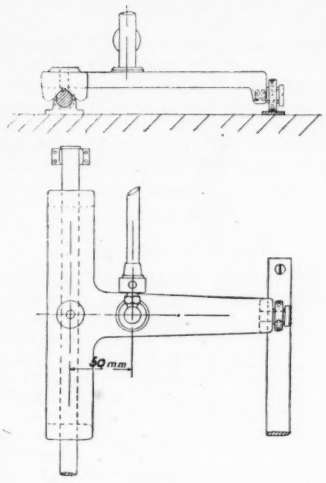


FIG. 2.

be lifted off the slide. In either case, the chimney should be removed so as not to reflect light upon the photoped.

(6.)—*The Slide, Connecting Rod, and Photometric Scale.*

The slide fixed to the table on which the bases of the burners move constitutes with either of them a geometric slide; there being the necessary five independent points of support. A rod of drawn brass, ½-inch in diameter, is supported by three feet screwed to the table so that its under surface is one-eighth inch above the table. This rod is screwed down so as to be 50 mm. to the left of the line (shown dotted in fig. 1), which joins the gas-burner with the slit in front of the photoped. Parallel with this, and at such a distance as to allow the wheel on the foot to run upon it, is screwed a piece of flat rolled brass, as shown. Exactly 50 mm. from the centre of the upright gas-pipe, and in a direction at right angles to the line of motion, a hole, ¼-inch in diameter, is made in the foot of each burner, into which a slightly tapered pin near one end of the connecting rod is to be placed, so that the burner may be pulled on the slide by the observer. This connecting rod is supported near the other end by a block, so placed that the rod is parallel with the dotted line already mentioned. The connecting rod has let into it, at the observer's end, a strip of white enamel glass, on which is etched a photometric scale extending from 9 to 17 candles, and divided into tenths of a candle. The index of the block is adjustable, so that when the argand burner is placed at the 10-candle distance by means of the measuring rod, as described under (12), the index may be clamped over the division 10. Then at all distances the number read upon the scale will accurately represent the candle power of the gas-flame.

(7.)—*The Connecting Pipes.*

These are to be made of ½-inch (outside measure) composition piping except in the case of the two pipes which connect the three-way tap on the table with the two burners, where flexible metallic tube is to be used. They are to be connected with the different pieces of apparatus by ⅜-inch unions, except in the case of the gas-meters, where the unions belonging to the meter may be retained. In all cases the boss of the union is to be attached to the apparatus, and the cap and lining to the ends of the connecting pipe. These pipes are to be placed above the table. No grooves, recesses, or holes, other than the screw-holes for the screws referred to in this appendix, are to be made in the table.

(8.)—*The Ten-Candle Pentane Lamp.*

The lamp is placed in position upon the table, the exact distance of the steatite ring from the photoped being determined by means of the measuring rod as described under (12). The swivel feet, which should fit loosely in the screws, shall then be clamped in position. The height of the top of the steatite burner is 353 mm. above the table.

(9.)—*The Photoped.*

The photoped is represented in fig. 3. It consists of the following parts: A plate, 100 mm. square, with a central hole, 21 mm. square. This is held in a vertical position by an upright support so that the centre of the square is 400 mm. above the table. The upright is carried by a tripod with flat feet clamped to the table by dogs as shown. To one face of the square plate is fastened, by two binding screws, a clamping plate, 60 × 40 mm., also with a central hole 21 mm. square, so that the two openings are opposite one another. The clamping plate carries centrally a horizontal tube about 35 mm. in diameter and 30 mm. in length. In this slides smoothly a smaller tube containing a diaphragm in which a rectangular slit, 25 × 7 mm. has been cut. A piece of suitable white paper is pinched between the two plates so as to cover the openings and project a little way below the clamping plate. To the upper surface of the square plate is fixed a strip of glass, so that the lower edge is close to, and exactly parallel to, the

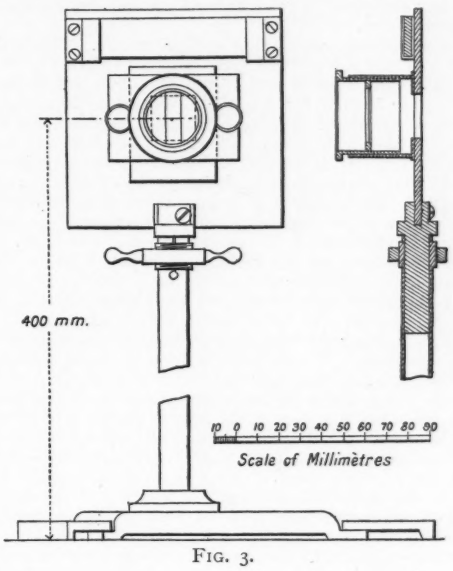


FIG. 3.

plate, while the upper edge is so much in advance as will allow the reflection of the flames described later on to be observed.

(10.)—*The Aerorthometer—See Appendix F.*

In using the aerorthometer, turn the screw up until the level of the mercury in the open tube is some distance below that of the mercury in the bulb tube. Then turn the screw slowly down until the mercury stands at the same level in both tubes. The division at which the mercury now stands is the aerorthometer reading. The Gas Examiner shall, not less often than once a month, compare the aerorthometer reading with the reciprocal of the "Tabular Number" deduced from observations of the barometer and thermometer; and if there is a difference of more than one-half per cent. the aerorthometer is to be re-adjusted. If at any time the aerorthometer is out of order, the reciprocal of the "Tabular Number" is to be used.

(11.)—*The Stop-Clock.*

This is the clock ordinarily used in testing places, either attached to the meter or independent of it. It must be provided with mechanism for starting and stopping. It will facilitate the comparison with the standard clock if it is made to give an audible sound, by means of a bell or otherwise, at the completion of each minute; and the number of minutes up to ten at least should be indicated by a separate hand.

(12.)—*Dark Screens; Mirrors; Measuring Rod.*

Five dark screens are provided in order to prevent the inaccuracy and inconvenience to which stray light would give rise.

The first is placed between the burners and the photoped in the position shown in fig. 1. This screen is 500 mm. wide and 400 mm. high, with its lower edge 100 mm. above the table. It has two rectangular openings. The opening to the left is 40 mm. wide and 55 mm. high, and its lower edge is 350 mm. above the table. The opening to the right is 75 mm. wide; its lower edge is 340 mm. above the table; and it extends to the top of the screen. The centre lines of these two openings are 300 mm. apart. The screen is carried by two feet hinged to the table as shown in fig. 1. Care must be taken that it is so placed that the whole of the flame under the tube C of the 10-candle lamp and the whole of the chimney and burner of the argand or the whole of the flat flame can be seen through all parts of the slit in front of the photoped when the paper is removed for that purpose.

The second dark screen consists of a piece of black velvet or black cloth 350 mm. square stretched on a frame and supported so that its lower edge is 150 mm. above the table. In this is cut a hole 50 mm. square with its lower edge 380 mm. above the table This screen is placed close to the photoped, but on the opposite side to that facing the lamps, and with the square hole opposite the square hole in the plate of the photoped. To the right side of the frame is hinged a light frame, 350 mm. high and 300 mm. wide, with its lower edge 150 mm. above the table. On this also is stretched black velvet or black cloth. This prevents the illuminated dial of the meter or arc of the regulating tap from interfering with the photometric observations, while at the same time it can be readily moved when these are to be observed.

The third dark screen is about 500 mm. wide and 570 mm. high. The fourth is about 450 mm. wide and 570 mm. high. These may be made of card, painted dead-black, or of thin wood, and may be placed approximately in the positions shown in fig. 1 and with their lower edges 180 mm. above the table.

The fifth dark screen consists of a piece of black velvet or cloth large enough to form a black background to the lamps when viewed from the photoped. It is best placed upon the wall; but if that is inconvenient or other objects intervene, it should be supported on a stand, but always so as to be at least 300 mm. behind the flames of the photometer.

Two small mirrors are carried on light stands. One of these is made of ordinary flat silvered glass, and is so placed as to enable the gas examiner, when seated at the photoped end of the table, on moving his head to the left of the second dark screen, to see by reflection the tip of the flame of the 10-candle lamp through the mica window in the tube. The other, which should be about 120 mm. in diameter, is convex, and should have a radius of curvature of about 400 mm. It is placed on the observer's right, and is so inclined that it casts a divergent beam of subdued light on the divided arc of the regulating tap, on the face of the meter, on the aerorthometer, and on the gas examiner's note-book.

All the apparatus on the table upon which light can fall, and which might by reflection illuminate the photoped, or catch the eye of the operator, is to be painted dead-black, or, if of finished brass, it is to be bronzed before being lacquered.

The correct position of the photoped and of the burners is to be verified as follows: A measuring rod has securely fastened to it transversely a cylindrical and shouldered plug which just fits into the steatite rings of the 10-candle lamp and of the Metropolitan argand; there being a step on the plug to enable it to be used for either. The rod is balanced about, and rests upon, the burner. The rod is to be 1000 mm. from the axis of the plug to the extremity of the rounded ivory point. The rod must be capable of being placed in either burner without disarranging it, except in the removal of the glass chimney of the Metropolitan argand or the conical shade of the 10-candle lamp. When the rod is in position upon either burner and the long end is moved gradually round towards the photoped, it should just come in contact with the paper under the clamping plate at the middle point.

When the burners have been lighted and the flames turned low, the reflection of one is to be observed over the other in the glass of the photoped. It should appear central. In that case the photoped is symmetrically placed with respect to the two burners. If the reflection does not appear central, the nut on the standard is to be loosened, and the plate turned until the reflection is central. The two lights are then to be turned up, and the slit is to be moved in or out, until the two rectangular spaces illuminated by the two lights just meet but do not overlap.

APPENDIX E.

The Metropolitan Argand Burner No. 2.

The burner which has been adopted as the standard burner for testing gas was devised by Mr. Charles Carpenter, and has been called by him the "Metropolitan Argand Burner No. 2."

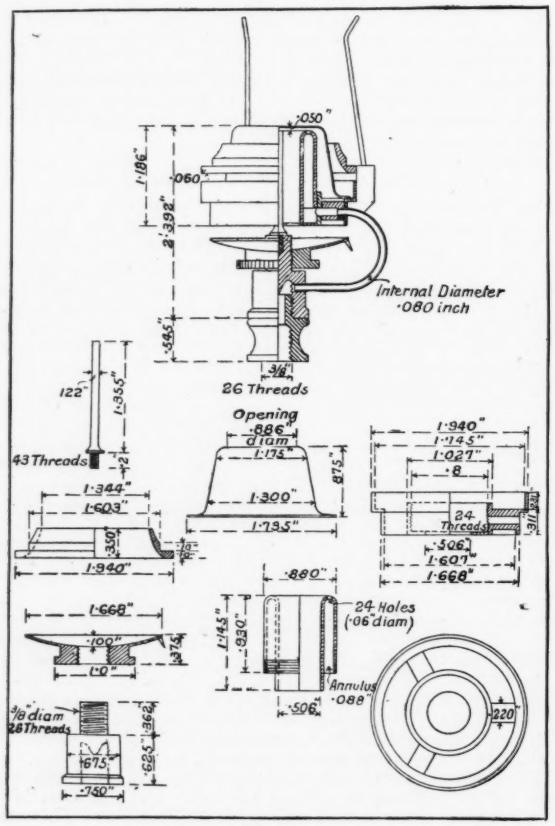


Fig. 4.

A half-sized drawing (showing details) is given in fig. 4, on which also are marked the important dimensions.

The annular chamber from which the gas issues is made of steatite.

The chimney to be used with this burner is 6 inches long and 1⅝ inches in internal diameter.

Each testing-place is provided with a box containing two wire gauges, one 0·058 inch, and the other 0·062 inch in diameter. The gas examiner must once in every month pass the smaller gauge through every hole in the burner, so as to clear out any loose obstruction, or detect any hard concretion that might interfere with the proper discharge of gas. He should at the same time satisfy himself that the larger gauge will not pass through the holes.

APPENDIX F.

The Aerorthometer.

This is illustrated in fig. 5. The mode of reading the instrument is explained in Appendix D. A reading furnishes the figure required for correcting the volume of a gas measured over water at any ordinary temperature and pressure to that which the gas would have if measured over water under a pressure of 30 inches of mercury, and at a temperature of 60° Fahr. Thus its reading corresponds to the figure derivable from a reading of the barometer and the thermometer, and a reference to a table giving the tension of aqueous vapour at different temperatures.

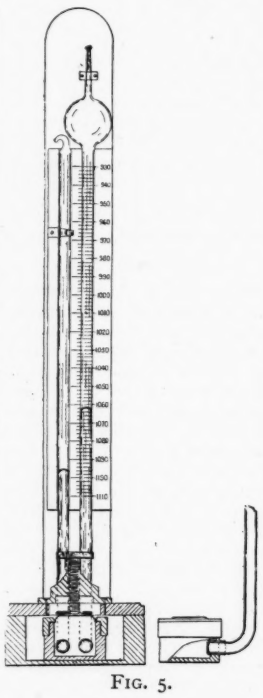


Fig. 5.

It consists of a bulb and vertical stem in which sufficient water is present to ensure that the air is saturated. The measuring tube, which terminates in a closed bulb, and a companion tube which is open to the air, dip into a reservoir of mercury in the base, the capacity of which can be adjusted by a regulating screw pressing on a leather cover. The relative volume of the bulb and tube down to any division, is represented by the number belonging to that division. The capillary tube above the bulb is closed by a very small amount of sealing wax. In order to adjust the instrument, the sealing wax is softened by heat and a small hole made through it. When the bulb has acquired the temperature of the air, the regulating screw is to be turned until the two columns of mercury stand just level at the calculated aerorthometer reading. Then the sealing wax stopping is again melted where it was perforated, by being touched from above with a heated wire; while the base of the tube and the bulb are protected from heat by a wrapping of cotton wool.

APPENDIX G.

Tabular Numbers.

This is the now well-known table—see "Journal" for May 31, 1898, pp. 1256-57—to facilitate the correction of the volume of gas measured over water at different temperatures and under different atmospheric pressures.

APPENDIX H.

Test for Sulphuretted Hydrogen.

The apparatus represented by fig. 6 consists of a plate with a circular channel, half-filled with mercury, in which rests a bell

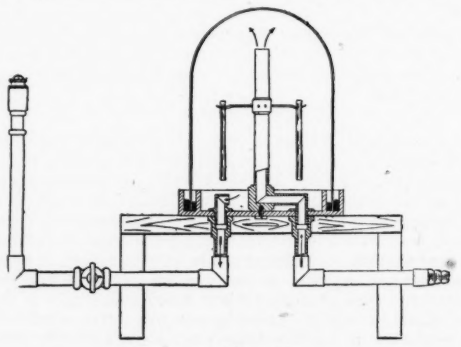


Fig. 6.

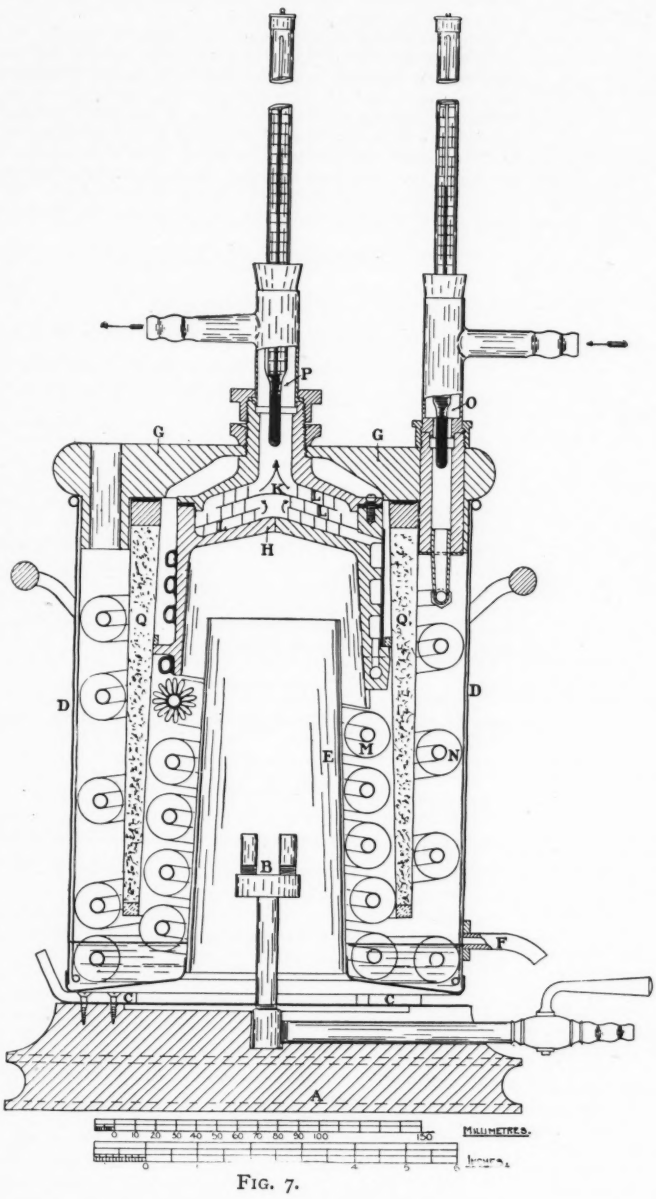


FIG. 7.

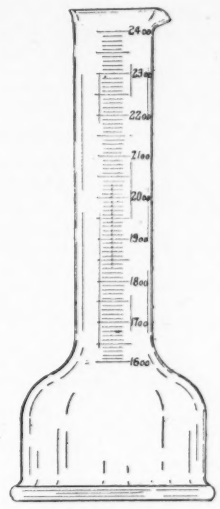


FIG. 8.

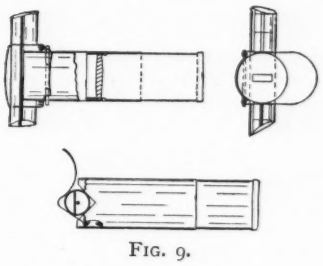


FIG. 9.

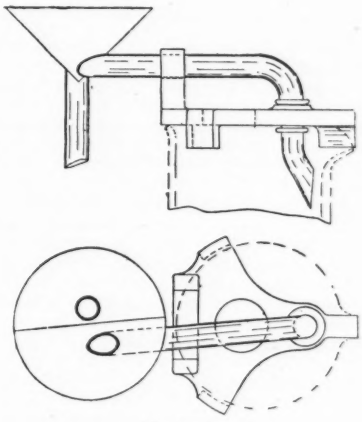


FIG. 10.

glass held down in position by an arm and cap (not shown). A central tube connected below with the gas-inlet rises nearly to the top of the bell-glass, and carries (midway) wires pointed and curved at the end, from each of which a slip of lead-paper hangs. A second pipe passing through the plate, and terminating above in a short elbow, provides an outlet for the gas, which is burnt as it issues from a governor burner passing gas at about the rate of 5 cubic feet per hour.

APPENDIX K.

SULPHUR TEST.

The arrangement and use of this apparatus—with its trumpet-tube over the gas-flame and its glass cylinder "packed with balls of glass, about 15 mm. in diameter, to break up the current and promote condensation"—are so familiar as not to need any further reference.

APPENDIX L.

THE GAS-CALORIMETER.

The gas-calorimeter, which has been designed by Mr. Boys, was fully described in the "JOURNAL" for Dec. 19, pp. 808-10, It is shown in vertical section in fig. 7, which is here reproduced for convenience of reference while reading the "official" description. It consists of three parts, which may be separated, or which, if in position, may be turned relatively to one another about their common axis. The parts are the base A, carrying a pair of burners B, and a regulating tap. The upper surface of the base is covered with a bright metal plate held in place by three centering and lifting blocks C. The blocks are so placed as to carry the vessel D, which is provided with a central copper chimney E, and a condensed water outlet F. Resting upon the rim of the vessel D are the essential parts of the calorimeter attached to the lid G. Beginning at the centre, where the outflow is situated, there is a brass box which acts as a temperature equalizing chamber for the outlet water. Two dished plates of thin brass K are held in place by three scrolls of thin brass L. These are simply strips bent round like unwound clock springs; and no attempt should be made to prevent all leakage from one spire to the next, as a little will be advantageous in encouraging temperature equalization. For the same reason, a little leakage from each spire to the one above may be allowed. The lower or pendent portion of the box is kept cool by circulating water, the channel for which may be made in the solid metal, as shown, on the right side, or by sweating on a tube as shown on the left. Connected to the water channel at the lowest point, by a union, are five or six turns of copper pipe such as is used in a motor-car radiator of the kind known as Clarkson's. In this, a helix of copper wire threaded with copper wire is wound round the tube; and the whole is sweated together by immersion in a bath of melted solder. A second coil of pipe, of similar construction, surrounding the first is fastened to it at the lower end by a union. This terminates at the upper end in a block, to which the inlet water box and thermometer holder are secured by a union, as shown at O. An outlet water box P, and thermometer holder, are similarly secured above the equalizing chamber H. The

CALORIFIC POWER OF GAS.

FORM WITH EXAMPLE OF CALCULATION.

Water. Inlet.	Water. Outlet.	Air. Inlet.	Air. Outlet.	Time by Stop Clock.
8·45° C.	33·22° C.	15° C.	12° C.	4 min. 2 sec. = 242 sec.
	·23	One-third difference = 1.		
	·23			
	·23	Barometer, 29·9 inches . .		} Tabular No. = ·997.
8·46	·21	Meter thermometer, 60° Fahr.		
	·22			
	·23			
	·23	Water collected, 2·080 litres.		
8·46	·23	Condensed water in 20 min. = 1200 sec., 40·3 c.c.		
	·22			
	·21			
	·23			
8·47	·24	Log. 24·7 = 1·3939		
8·46	·24	Log. 3 = ·4771		
	·24	Log. 2·080 = ·3181		
	53·41		2·1891	
	3·682	Log. ·997 = $\bar{1}$·9987		
	33·23	Log. 155·0 = 2·1904		
	8·46			
	24·77	Subtract 1·0		
		154·0 = Gross Calorific Power.		

Log. 40·3 = 1·605 Log. 1200 = 3·079
Log. 242 = 2·384 Log. ·997 = $\bar{1}$·999
Log. 1·86 = ·270 3·078

4·259
Gross 154·0 3·078

Log. 15·2 = 1·181

138·8 = Net Calorific Power.

lowest turns of the two coils M N are immersed in the water, which in the first instance is put into the vessel D.

Between the outer and inner coils M N is placed a brattice Q, made of thin sheet brass, containing cork dust to act as a heat insulator. The upper annular space in the brattice is closed by a wooden ring, and that end is immersed in melted rosin and beeswax cement, to protect it from any moisture which might condense upon it. The brattice is carried by an internal flange which rests upon the lower edge of the casting H. A cylindrical wall of thin sheet brass, a very little smaller than the vessel D, is secured to the lid, so that when the instrument is lifted out of the vessel and placed upon the table the coils are protected from injury. The narrow air space between this and the vessel D also serves to present interchange of heat between the calorimeter and the air of the room.

The two thermometers for reading the water temperatures and a third for reading the temperature of the outlet air are all near together and at the same level. The lid may be turned round into any position relatively to the gas-inlet and condensed water drip that may be convenient for observation; and the inlet and outlet water boxes may themselves be turned so that their branch tubes point in any direction.

A regular supply of water is maintained by connecting one of the two outer pipes of the overflow funnel shown in fig. 4 of p. 809 of the "JOURNAL" for Dec. 19 to a small tap over the sink. The overflow funnel is fastened to the wall about 1 m. above the sink, and the other outer pipe is connected to a tube in which there is a diaphragm with a hole 2·3 mm. in diameter. This tube is connected to the inlet-pipe of the calorimeter. A piece of stiff rubber pipe long enough to carry the outflow water clear of the calorimeter is slipped on to the outflow branch, and the water is turned on so that a little escapes by the middle pipe of the overflow funnel, and is led by a third piece of tube into the sink. The amount of water that passes through the calorimeter in four minutes should be sufficient to fill the graduated vessel shown in fig. 8 to some point above the lowest division, but insufficient in five minutes to come above the highest division. If this is not found to be the case, a moderate lowering of the overflow funnel, or reaming out of the hole in the diaphragm, will make it so.

The thermometers for reading the temperature of the inlet and outlet water should be divided on the Centrigade scale into tenths of a degree, and they should be provided with reading lenses and pointers, such as are shown in fig. 9, that will slide upon them. The thermometers are held in place by corks fitting the inlet and outlet water boxes. The thermometers for reading the temperature of the air near the instrument, and of the effluent gas, should be divided on the Centigrade scale into degrees.

The flow of air to the burners is determined by the degree to which the passage is restricted at the inlet and at the outlet. The blocks C, which determine the restriction at the inlet, are made of metal $\frac{3}{16}$ inch thick, or about 5 mm.; while the holes round the lid, which determine the restriction at the outlet, are five in number, and are $\frac{5}{8}$ inch, or 16 mm., in diameter. The thermometer used for finding the temperature of the effluent gas is held by a cork in the sixth hole in the lid, so that the bulb is just above the upper coil of pipe.

The calorimeter should stand on a table by the side of a sink, so that the condensed water and hot water outlets overhang and deliver into the sink. A glass vessel must be provided, of the size of the vessel D, containing water, in which is dissolved sufficient carbonate of soda to make it definitely alkaline. The calorimeter after use is to be lifted out of its vessel D and placed in the alkaline solution and there left until it is again required for use. The liquid should not, when the calorimeter is placed in it, come within 2 inches of the top of the vessel. The liquid must be replenished from time to time, and its alkalinity must be maintained.

A suitable change-over funnel is shown in fig. 10.

APPENDIX M.

THE GAS REFEREES' STREET-LAMP PRESSURE-GAUGE.

This instrument for testing in any street at any hour the pressure at which gas is being supplied is too well known to need any description.

APPENDICES N, O, AND P.

None of these need detailed reference. The first describes the one-twelfth of a cubic foot measure designed by Mr. Harcourt, and fully detailed in the "JOURNAL" for May 31, 1898, p. 1259. Appendix O gives the form to be used by the Metropolitan Gas Examiners when reporting the results of their tests. Appendix P points out that the Referees are at all times ready to loan to the testing-stations parts of apparatus that may get out of order or be broken, so as to prevent the necessity of suspending gas-testing operations during repairs or replacements.

HIGH-PRESSURE GAS DISTRIBUTION TO-DAY.

Where the System is in Use.

In the editorial remarks in the "JOURNAL" for Dec. 5, on the paper read at the annual meeting of the American Gaslight Association, by Mr. H. L. Rice, of Aurora (Ill.), on high-pressure gas distribution, the text of which was given in another part of that issue (p. 679), it was mentioned that the author had supplied in an appendix a list of places where the system is in use. This interesting addition to his communication we now reproduce.

HIGH-PRESSURE TRANSMISSION INSTALLATIONS
(PRESSURES OF ONE POUND OR MORE)
AND REINFORCING SYSTEMS OPERATED IN THE UNITED STATES.

Camden (*N. J.*).—Thirty-five miles of 12-inch wrought-iron main to a holder at Trenton. Supplies Riverton, Burlington, and lesser places *en route* through district regulators. Compressors used.

Chicago (*Ill.*).—High pressure, supplied by compressors, is used extensively in Chicago for transferring gas between holders. One line, upwards of 5 miles long, delivers over a million feet a day.

Fall River (*Mass.*).—Transmission to outlying holders at 3 lbs. pressure by blowers.

Hackensack (*N. J.*).—Six miles of 5-inch forcing-main to holder at Rutherford. Duplicate Ingersoll-Sergeant compressors. About 12,000 feet delivered per hour, requiring about 5 lbs. pressure.

Long Branch (*N. J.*).—Seven miles of 16 and 12 inch cast-iron main to Asbury Park, with 7-mile branch of 10-inch main to Red Bank; 2 lbs. pressure. Exhauster used. Equitable house regulators used along the line. Several small branch mains are supplied with low pressure through regulators. System in operation since 1896.

Louisville (*Ky.*).—Ten-inch wrought-iron line, $2\frac{3}{4}$ miles to outlying holder; 6 lbs. pressure. Compressor used.

Norfolk (*Va.*).—High-pressure pumping line from 6-inch low-pressure main in south-east part of city to holder across river in Berkley; 3-inch wrought-iron pipe-line to and from river bank; $1\frac{1}{2}$-inch lead pipe across river; 3 lbs. pressure. Delivers 3000 cubic feet per hour. Laidlaw-Dunn compressor, electric driven; 1 kilowatt per 1000 cubic feet delivered.

Oakland (*Cal.*).—Eight-inch cast-iron line, 8 miles to outlying holder in Alameda, 5 lbs. pressure; also reinforces two low-pressure districts through Connelly governors. Roots exhauster.

Rockaway Beach (*N.Y.*).—Five-and-a-half miles of 4-inch pipe to holder at Far Rockaway, and $7\frac{1}{2}$ miles of 6-inch pipe from there to holder at Lynbrook. The 4-inch is wrought-iron screw pipe, with Dresser sleeves every 1000 feet. The 6-inch is wrought-iron pipe with Dresser joints throughout. Duplex Ingersoll-Sergeant compressor, 15 to 40 lbs. pressure. Considerable condensation. Reinforcing at one point by valve connection.

Seneca Falls (*N.Y.*).—High-pressure pumping line from works to

holders at Seneca Falls and Waterloo; 26 miles of line passing under Cayuga Lake; 6 lbs. pressure.

HIGH-PRESSURE TRANSMISSION LINES WITH LOW-PRESSURE DISTRIBUTION DIRECT THROUGH DISTRICT GOVERNORS.

Altoona (*Pa.*).—Six miles 3-inch wrought-iron pipe to Hollidaysburg. Westinghouse compressor, 6 lbs. pressure; district regulators at Hollidaysburg; individual regulators along the line; ¾-inch services.

Aurora (*Ill.*) *Western United Gas and Electric Company*.—This system comprises various methods of high-pressure distribution, and it was fully described in the body of the paper (see *ante*, p. 682).

Chester (*Pa.*). –Nine miles of wrought-iron line, Dresser joints, to Darby and Media. The line to Darby is 6-inch, and the branch to Media is 4-inch; district governors used. Also serves the territory of the Suburban Gas Company of Philadelphia—some 3000 customers—through about 40 miles of direct high-pressure mains and services.

Chicopee (*Mass.*).—Five miles of 3-inch line to Williamsett, with 2½-inch branch, 3 miles long, to small suburb. District governor in Williamsett. The 2½-inch line is a direct high pressure, but also reinforces low-pressure system of Chicopee Falls; 10 lbs. pressure carried. Westinghouse compressors.

Danbury (*Conn.*).—Two-inch wrought-iron line to Bethel, 4 miles; 40 lbs. pressure; two compression-tanks and district regulator at Bethel. Compressor used. The Superintendent writes: "I can only say that we are still supplying Bethel in the same way and with the same apparatus. The service is satisfactory; and the business is slowly growing."

De Kalb (*Ill.*).—Six miles of 4-inch line to Sycamore; duplicate Rand drill compressors, 15 to 20 lbs. pressure; duplicate Johnson-Reynolds district regulators at Sycamore; Johnson-Reynolds house regulators along the line.

East Saginaw (*Mich.*).—Four-inch emergency high-pressure line of extra heavy pipe across river; Dresser river sleeves at each coupling. Rand drill compressor; Johnson-Reynolds district regulator. This is auxiliary to a 12-inch low-pressure main.

Elizabeth (*N.J.*).—About 15 miles of 8, 6, and 4 inch wrought-iron main; screw joints, with Dresser coupling, every 250 feet. Begins at Elizabethport, reinforces the outskirts, and the low-pressure system of Roselle, Cranford, and Westfield; supplies Rahway, Linden, and Woodbridge, helps out Perth Amboy branches, and supplies three other points. Further extension contemplated. Johnson-Reynolds district and house governors used. Only moderate pressure, supplied by exhauster, is now carried; but the line is designed for high-pressure as required.

New Orleans (*La.*).—Eight-inch high-pressure steel line under Mississippi River to Algiers; district governor at Algiers. This remarkable line was fully described in a paper by Mr. Thomas D. Miller, before the Western Gas Association, at their meeting in 1903.* On the New Orleans side it is joined to the reinforcing system, separately listed.

North Adams (*Mass.*).—Five miles of 3-inch wrought-iron pipe to Williamstown, and 5 miles of 4-inch to Adams; two distinct lines. Duplicate Johnson-Reynolds district governors in each town; Johnson-Reynolds house regulators on the line. System very satisfactory, and low-pressure system free from frost.

Phœnixville (*Pa.*).—Five-mile line to Royersford and Spring City; 3-inch line, with Equitable and Fulton district governors; 20 lbs. compression.

Schenectady (*N.Y.*).—4300 feet of 4-inch line to General Electric Company's plant; 10 to 35 lbs. pressure. The General Electric Company take charge of this within their own plant.

Sunbury (*Pa.*).—One mile of 2-inch wrought-iron main laid this year to Susquehanna silk-mills. It was laid to avoid taxing the low-pressure system, which it will ultimately reinforce. Clayton duplex compressor, 15 lbs.

HIGH PRESSURE DIRECT.

Amesbury (*Mass.*).—Direct system; 350 consumers.

Blue Island (*Ill.*).—High-pressure system throughout. Supplies Harvey, Morgan Park, Riverdale, and Posen; 60 miles of mains, 6-inch to 1½-inch wrought-iron pipe, with Dresser couplings at intervals and Dresser specials; 15 lbs. pressure. The North-Western Gaslight and Coke Company state that the system is so satisfactory that a line was run from the Cicero works last year into a thinly-settled territory; and 25 miles will be run to supply the villages west from Evanston.

Chicago Heights (*Ind.*).—High-pressure system throughout; 2 miles of 4-inch, 3 miles of 2-inch, and 10 miles of 1¼-inch mains. Rand drill compressors, 12 to 8 lbs.; ¾-inch services, with a few of larger power; Johnson-Reynolds house regulators, with mercury seals.

Delray (*Mich.*).—Direct system to adjoining towns; 5 miles of 4-inch wrought-iron pipe; Rand drill straight-line compressors. System in operation only since Feb. 10, 1905.

Dover (*N.J.*).—5 miles of 3-inch wrought-iron pipe to Port Oram, with 3-inch to 1½-inch mains in the town. M'Kiernan compressor, operated by Backus gas-engine; 5 lbs. pressure. Equitable house regulators, with expansion sleeve every 1000 feet. Some frost trouble was reported where the streets were graded and the pipe was left only 1 ft. 6 in. deep.

* See "JOURNAL," Vol. LXXXIII., p. 175.

Easton (*Pa.*).—Two miles of 4-inch wrought-iron pipe to a district of 7000 population; 10 to 20 lbs. pressure. A duplicate tandem district governor in the centre of the district reduces the pressure to 3 inches; condensation collecting chamber 1000 feet from compressor. No trouble, and very satisfactory.

Grass Valley (*Cal.*).—Four-and-a-half miles of 2-inch ne to Nevada City; mains in Nevada City 1½-inch to ¾-inch; services ½-inch. Gas compressed to 100 lbs. into storage tanks at works; enters line through regulator set at 15 lbs. pressure; enters main system at Nevada City through a second regulator set at 4 lbs. Individual regulators reduce pressure to 4 oz.

Hammond (*Ind.*), *South Shore Gas and Electric Company*.—Forty-six miles of direct high-pressure 2-inch to 1½-inch mains, covering Hammond, Whiting, Indiana Harbour, and East Chicago. Rand drill straight-line compressor, 10 lbs. pressure; Johnson-Reynolds house regulators, and National Machine Works mercury seal. The taps in mains are ½-inch; and the lock-cocks have ¼-inch opening.

Hancock (*Mich.*)—Direct system throughout Hancock, and supplies Houghton, across lake 47 feet deep; 12 miles of 4-inch to 2-inch mains. Expect to lay 30 miles this year to reach and pipe Laurium. Westinghouse compressors, delivering into compression tanks at 40 lbs. pressure. Regulator on the outlet of the tank reduces pressure to 8 lbs., which gives 6½ lbs. at the far end. Solid rock country. High pressure adopted partly that mains could be laid shallow. No frost trouble. Services 1¼-inch to ¾-inch. Johnson-Reynolds house regulators.

Ishpeming and Negaunee (*Mich.*).—New plant; direct system; no low pressure; about 12 miles of main, 4-inch to 1¼-inch, laid this year.

Linton (*Ind.*).—New plant; direct system; no low pressure; 6 to 7 miles of main, 4-inch to 1¼-inch, laid this year.

Long Beach (*Cal.*) *and Vicinity*.—Direct system throughout; 22 miles of 4-inch to 2-inch pipe. Same methods as at Pasadena.

Los Angeles (*Cal.*).—At the present time this high-pressure system covers the south-western and south-eastern portion of the city of Los Angeles, with 12 miles of 6-inch and 10-inch wrought-iron pipe, six Equitable district governors being used to reduce the pressure from 15 lbs. to inches. Also 10 miles of 6-inch wrought-iron high-pressure pipe, supplying part of the eastern section of the city of Los Angeles and the city of Pasadena. Consumers at the latter place are supplied through a district governor; while the eastern section of Los Angeles is fed direct from the high-pressure mains through gas-regulators of the Reynolds and No. 1 Equitable types. On this line there are also 3 miles of high-pressure branch lines supplying some 200 consumers in the city of Alhambra; also 9 miles of 6-inch and 8-inch high-pressure lines running to the city of Hollywood. Consumers at Alhambra and Hollywood are supplied with individual consumers' regulators. The present hourly output capacity of the compressors is 370,000 cubic feet of gas.

Marlboro' (*Mass.*).—Supplies Hudson by a direct system; 35 lbs. pressure.

Norfolk (*Va.*).—Eight miles of high-pressure main, 3-inch to 1¼-inch wrought-iron pipe, supplying northern suburbs; direct system. Rand drill straight-line compressor, stopped at 25 lbs. and started at 5 lbs. Equitable and Johnson-Reynolds house regulators.

Oakland (*Cal.*).—Three-inch to 6-inch cast-iron pipe to Berkley, 11 miles; 2⅓ lbs. pressure or less, as required; connected direct into low-pressure system at Berkley, which is tied into low-pressure system at Oakland. Individual regulators along the first 3 miles of the line.

Pasadena, South Pasadena, and Alhambra (*Cal.*).—Direct high-pressure system throughout; 43 miles of 6-inch to 2-inch pipe. Gas compressed into storage-tanks at from 80 to 100 lbs. pressure, and delivered through a regulator to give 20-inch to 25-inch pressure at farthest point. Individual house regulators of the Lowe pattern.

Pittsfield (*Mass.*).—About 25,000 feet of 4-inch wrought-iron pipe to Dalton; high-pressure throughout Dalton, 2-inch, 1¼-inch, and ¾-inch mains. Westinghouse air-brake pumps used as compressors, and very satisfactory; Dresser insulating joints every 500 feet; valves every ½ mile; Hickenlooper coating.

Redwood (*Cal.*).—Five miles of 3-inch line laid this year to supply Palo Alto on the direct system.

Redwood City (*Cal.*).—Eight miles of 2½-inch line to San Mateo, and 2-inch belt line round San Mateo, with 1-inch mains in the town. Straight-line compressor, 10 to 35 lbs. pressure; Equitable regulators; expansion joints every 1000 feet.

St. Louis (*Mo.*).—Six-inch steel screw pipe, with 2-inch and 1¼-inch branches from outlying station located on medium-pressure belt line to the suburb of Webster Groves. Two gas-engine driven compressors, each of a capacity of 5000 cubic feet per hour, delivering at 30 lbs. pressure. A few Dresser insulating couplings are used, and the line is further protected from electrolysis by pitch where this is deemed necessary. Individual house regulators of the Johnson-Reynolds type are used.

Santa Rosa (*Cal.*).—16·8 miles of 2-inch steel pipe to Petaluma; 2-inch to ¾-inch steel mains in Petaluma. Compressor used, with pressure of 10 to 40 lbs., according to demand.

Sterling (*Ill.*).—Direct system supplying the first ward of Sterling and the city of Rock Falls; 4-inch to 3-inch wrought-iron mains, with Dresser insulating joints at intervals; no drips. Electricity-driven Erie compressor, requiring 1·1 kilowatts per 1000 cubic

feet of gas pumped at 30 lbs. pressure. Johnson-Reynolds house regulators.

Waukegan (Ill.)., North Shore Gas Company.—Supplies seven towns (two added this year) through 55 miles of steel pipe, 6-inch to 1¼-inch; straight-line compressors, 30 lbs. pressure; specially designed drip tanks at works. Two pairs of outlying compression storage tanks in service, each holding 3000 cubic feet at 30 lbs. pressure. All districts except two are direct high pressure; but two are served through district governors. Some 6-inch main is cast iron, with special joints.

Reinforcing Systems.

Atlanta (Ga.).—Two miles of cast-iron independent main, delivering direct into low-pressure system; Sturtevant fan to give 15-inch pressure. Not at present in use, as main system has been enlarged.

Baltimore (Me.).—Two independent reinforcing lines—one 3 miles long, and connecting into the low-pressure system at the far end; the other, a pumping line between two stations, having direct valve connection into the low-pressure system. Sturtevant exhauster is used when required. These two lines were put in use one year ago, and they have resulted in reducing the maximum pressure of the low-pressure system from 8 down to 4 inches.

Cleveland (Ohio).—Three miles of 6-inch wrought-iron main, with Dresser joints throughout, reinforcing one district from the old station. Ingersoll-Sergeant duplex compressor, 10 lbs. pressure. Supplies low-pressure mains through district governor.

Detroit (Mich.).—There are 65,136 feet of 16-inch cast-iron reinforcing main in use in Detroit. Now using cement joints. Expect to carry 2 lbs. pressure or more this winter.

Evansville (Ind.).—Just starting to run a 4-inch high-pressure main around the outskirts of the city to take in new territory and reinforce the low-pressure system.

Fresno (Cal.).—Two-inch reinforcing line completely round the city, and 2 high-pressure branches to outlying districts. Some trouble with condensation, which, however, is mostly removed within 1000 feet of the compressor. Connection to low-pressure system is through regulators; 15 lbs. pressure carried with perfect satisfaction. High-pressure services are ½-inch.

Indianapolis (Ind.).—Two-and-half miles of 10-inch reinforcing main (a former natural-gas main) are just being put in service this year. Laidlaw-Dunn compressor, 10 lbs. pressure. This line will connect, through a single Johnson-Reynolds 6-inch regulator, with the 16-inch low-pressure main in the heart of the city.

Kansas City (Mo.).—Four miles of 16-inch cast-iron pumping main, delivering direct into the low-pressure system at points 2 miles from the works and beyond; 18-inch pressure when required. Sturtevant fan blower. System in use since 1895.

Lansing (Mich.)—Three-inch reinforcing line to suburbs. Westinghouse compressor, 15 lbs. pressure; district regulator in manhole, connecting into low-pressure mains, with safety blow-off.

Milwaukee (Wis.).—About 13 miles of cast-iron boosting main, 24-inch, 20-inch, and 16-inch; lead joints, tested to 70 lbs. pressure, connecting through 12 governors, 6-inch, 10-inch, and 12-inch, into low-pressure system. Connelly governors set two in tandem in water-tight manholes; 20-inch pressure at works, supplied by Root's blower. Expect to lay more main, add more governors, and increase pressure as required. Variations in pressure on low-pressure system reduced to less than 1-inch.

Minneapolis (Minn.).—From 5 to 6 lbs. is carried by a Root's exhauster at the works on an independent main, delivering direct into the low-pressure system 3 to 4 miles distant. Not entirely satisfactory.

Newark (N.J.).—Here the mains to the outlying holders are connected direct through valves into the low-pressure distribution system. The pressure on these pumping lines is maintained by positive exhausters and Sturtevant fans.

New Orleans (La.).—Some 8 miles of 6-inch, 4-inch, and 3-inch high-pressure mains radiate from works in New Orleans, and connect, through governors, at five different stations with the low-pressure system. These governors are two in tandem, with duplicate set. The first governor reduces from 25 lbs. to 8 oz.; the second from 8 oz. to 2 inches.

Newton (Mass.).—There are 9600 feet of 6-inch iron pipe, with "Learned" joint, reinforcing the low-pressure system through the district regulator. Water-cooled condenser at compressor.

New York City (N.Y.).—There has been a 24-inch cast-iron independent main in the lower part of the city in use since 1880, connecting direct into the low-pressure system. The pressure is carried up to 1 lb. as required. Governed from station by electric recording device.

Omaha (Neb.).—Two miles of 12-inch cast-iron main from the works to the outlying Connelly governor. Pressure of 30 inches carried in winter by an ordinary exhauster; fan used for higher pressures.

Philadelphia (Pa.).—Extensive system of pressure mains for transferring gas between the several works and the outlying holders (pressures of 30 up to 60 inches), and used to some extent for reinforcing low-pressure areas by valve connections and one governor connection.

St. Louis (Mo.).—A detailed description of the 5-lb. boosting system in St. Louis is given in the paper (see *ante*, p. 682).

St. Paul (Minn.).—Now laying two miles of 3-inch reinforcing main of "Universal" pipe. Will instal a compressor and storage-tanks at the station, and discharge from the reinforcing main at selected points into the city mains.

Installations Abroad.*

Granton (Scotland).—Five pounds pressure on pumping line to holders.

London (South Metropolitan Gas Company).—Two 48-inch cast-iron pumping lines to outlying holders, with direct connection through governors to low-pressure system; 2 lbs. pressure carried.

Nuneaton (England).—Five miles of high-pressure main, supplying outlying districts, consisting of 3-inch bell-and-spigot steel pipe with lead joints, and 2-inch and 1-inch wrought-iron screw pipe. The compressors deliver into a 15,000 cubic feet high-pressure holder at the works, at 40 lbs. pressure. A regulator valve at the outlet of this tank reduces the pressure to 9 lbs. on the system. Individual house regulators are used, reducing the pressure to from 3 up to 20 inches.

Heidelberg (Germany).—High-pressure line to Ziegelhausen, Neuenheim, and Schlierbach; 6-inch to 3-inch mains. Rotary blowers, giving pressures up to 55 inches; district regulators used, reducing to 1·5 inches.

Lubeck (Germany).—A 12-mile line of 3·2-inch steel bell-and-spigot pipe to a holder at Travemünde; lead joints, tested to 15 lbs. pressure. Electricity-driven compressor to raise the pressure when required to perhaps 10 lbs. Only the holder pressure is required at Lubeck as yet.

St. Margrethen (Switzerland).—A 6-inch to 5-inch high-pressure cast-iron main, with lead joints, reaching nine towns in two branches from the works. Will later take in fourteen towns, with an aggregate population of 40,000. One small low-pressure holder for every two towns, automatically cut off from the pumping main when full. Holder pressure of 12 inches, *plus* natural elevation, is sufficient so far; but two exhausters are in readiness for additional pressure up to 240 inches, with automatic pressure bye-pass. This region is at the southern end of the Lake of Constance.

New Work Reported.

Logansport and Wabash Valley Gas Company.—Will pipe 16 miles, from Peru (Ind.) to a holder at Logansport, with 8-inch line, and 15 miles in the opposite direction, to Wabash, with 6-inch. Will use compressors and high pressure. Plans not fully developed.

Plymouth (Pa.), Wyoming Valley Gas and Electric Company.—Now building five plants for high-pressure work.

Oakland (Cal.).—Now laying 20,000 feet of 10-inch reinforcing main through the centre of Oakland, tested to carry 100 lbs. pressure; 20 lbs. to be carried at the start. A second compressor will compress from 20 to 80 lbs. for storage in compression tanks, which will deliver at 20-lbs. pressure through a regulator.

Sacramento (Cal.).—High-pressure work is now being planned for the Sacramento system. There will be several novel features in connection with this work and that at Oakland.

Steelton (Pa.), Dauphin Consolidated Gas Company.—Now installing a high-pressure system.

* These installations have been noticed from time to time in the "Journal."

The "Question-Box" of the Ohio Association.

We learn from Mr. Henry L. Doherty, of Denver (Col.), that he has been again elected Editor of the "Question-Box" of the Ohio Gaslight Association, and that the edition for the current year will be presented at the next annual meeting of the Association, to be held at Cincinnati on March 21 and two following days. It is expected that a prominent place will be given to the English contributors to this year's volume, and the list of questions will be sent to the addresses secured, through the medium of the "Journal," in getting out the edition for the year, 1905. To these have been added the names and addresses of a number of other English gas engineers and managers. This year the printed questions will be sent direct from Mr. Doherty's office, and he will be glad to have returned direct to No. 405, Seventeenth Street, Denver, Colorado, the answers to such questions as the recipients wish to take up. As considerable time is occupied in transit, he requests that all answers should be mailed not later than the 20th inst., to ensure inclusion in the publication. Mr. Doherty asks us to assure English gas engineers and managers that their co-operation is very heartily appreciated; and he feels strongly that a closer relationship will result in much good to the profession.

In a letter which appeared in a recent number of "Nature," Sir W. Gowers showed that as long ago as the Seventeenth Century heat was recognized as a mode of motion. He quoted the following statement from the "Medulla Medicinæ, by J. A. Van der Linden, dated 1642: "Calor est minutissimarum materiæ partium motus in se reverberatus." Sir W. Gowers remarked that though Van der Linden was a famous teacher, the theory might not have originated with him; and he asked for information as to other contemporary anticipations of "Heat a Mode of Motion."

ELECTROLYSIS.

The Attacking of a Water-Pipe Results in Lead-Poisoning.

A paper of considerable importance was that read by Mr. BALDWIN LATHAM, M.Inst.C.E., before the recent meeting of the British Association of Water-Works Engineers, on "Plumbism due to Electrolysis." From it and the discussion we have taken the salient points.

There has recently occurred in the district of the South Hants Water-Works Company a case of lead-poisoning arising from the use of the Company's water in a cottage on the Twyford Lodge estate at Twyford, Hants. The water is procured from wells in the chalk. The district in which lead was discovered in the water draws its supply from the Twyford pumping-station, the waters of which are taken from a well, and are softened with lime by the Haines' method. The waters are noted for their remarkable purity for chalk water, and are softened down to 4° or 5° of hardness before being passed into the mains of the district.

On Oct. 11 last, the Water Company received a letter from Dr. G. A. E. Roberts, of Twyford, the Medical Officer of Health of the New Winchester Rural District Council, pointing out that in a sample of water taken from a cottage at Twyford, there was a considerable trace of lead. He mentioned that the pipe, which was a ¾-inch lead service, was rather long; but he did not think the water supplied by the South Hants Company had any solvent action upon lead. An inmate of a cottage at the end of this lead service-pipe was suffering from lead-poisoning.

A piece of the service-pipe was cut out, and sent direct to the author by Mr. G. Greenslade, the Manager of the water-works; and it contained a white deposit. The Manager explained that the water near the end of the lead service was cloudy; but drawn from the same service near the main, it was quite clear. The sample of pipe was then forwarded to the Company's chemists (Messrs. Ogston and Moore) with a view to them ascertaining what was the nature of the deposit. A sample of lead pipe was also sent with a view to having the pipe itself analyzed; and it was found to be perfectly pure lead. A sample of water taken from the house in which the case of plumbism had occurred was also submitted to the chemists, and was found to contain 0·14 grain of lead per gallon. The chemists reported at the same time that they had made a test of the water taken from the Twyford pumping-station as to its effect upon lead. They stated: "We placed some pieces of pure lead in a small quantity of water (both the well and the reservoir), allowing them to stand for 24 hours, when they were tested for lead, but we could find no trace of it. We repeated the experiment; but this time allowing them to stand for 48 hours. In this case there was the faintest trace, but not estimatable. We made another experiment, this time using composition pipe, but without result. The water had no action upon it."

After an inspection of the site, and considering the circumstances, the author was of opinion that the presence of lead in the water was entirely due to electrolysis. The water-service had clearly been attacked after passing the engine-house and storage batteries used for the electric lighting of Twyford Lodge. This opinion was also communicated to the chemists, who stated that it was a very important and interesting point, and suggested that they should make some experiments at their laboratory, and report the final results of these experiments. In their report to the Directors on the result of this experiment, the chemists say: "We passed a current of electricity through the water contained in the pipe, allowing the action to go on over-night. In the morning, the water was tested; and it was found that a decided action had taken place, the activity having increased from 0·005 to 0·03. On the surface of the water, we noticed some white powdery substance floating, and on the inside of the pipe several white patches had appeared. On examination, the powdery substance was found to be carbonate of lead; and we have no doubt the white patches are also carbonate of lead, which is beginning to form a crust on the inside of the pipe. We are of opinion, therefore, that the pipe in question is affected by its vicinity to the electric cable spoken of by Mr. Baldwin Latham, and that the corrosion of the pipe is entirely due to electrolysis."

At that time—having regard to the suggestion which had been made by the author that the action was due to electrolysis—it appears that Dr. Roberts discovered a feeble current of electricity from the tap in the house in which the case of lead-poisoning had occurred; and he also found it in other portions of the Company's district. The consequence was that the Company determined to carry out a further investigation; and Messrs. Lucas and Pyke, electrical engineers, of Westminster, were instructed to make an inspection of the premises, and test the mains at Twyford with a view to ascertaining what was taking place. A test was made at Twyford in the presence of the electrical engineer of the owner of the property affected and others. Messrs. Lucas and Pyke say in their report that the pipe in which the electrolysis had taken place was a lead pipe, between 200 and 300 yards long, connected to the cast-iron main of the Water Company. After it left this cast-iron main, a branch from it was carried to Twyford Lodge, the residence of the owner of the property; and it then ran away in an opposite direction from the house in question, and passed near the engine-house where the electric plant supplying the current to Twyford Lodge is situated. A branch water-pipe was carried into the engine-house; and the pipe continues thence, and is forked to supply two cottages—this latter portion of the pipe being comparatively new. It was in the most distant of these cottages that the case of lead-poisoning took place. They also reported that they were shown two sections of pipe, one removed from the older part of the pipe before it reached the engine-house branch, and the other from the branch pipe supplying water to the cottage in which the case of lead-poisoning had occurred, the latter of which showed a considerable deposit of what had been ascertained to be carbonate of lead. The older section showed very little of this deposit, but, as might be expected, a strong deposit of oxide.

In order to ascertain the possible source of the leakage of electric current to these pipes, careful tests were made to find out any difference of potential between any section of the pipes themselves, and the pipes and the surrounding earth. The result of these tests was to indicate that the earth immediately under and round the engine-house showed a positive charge as compared with the pipes running away from this house; the isolated branch-pipe supplying the engine-house showing the biggest difference when connected with the lead pipe that was continuous to the cast-iron main. The main was proved to be negative as compared with any part of the ground in the immediate vicinity of the engine-house. A distinct difference of potential was obtained, not of large amount, or exceeding 0·2 volt in any case, which Messrs. Lucas and Pyke state would not be sufficient in their judgment to account for the comparatively extensive electrolysis that had occurred. They also state that it was clear, from the fact that the South Hants water-main was negative in every case, that the current could not have come from that direction. They, therefore, proceeded to examine the nature of the installation supplying the current to the premises, and found that an earthed return system had been adopted. From the information obtained and the inspection of what could be seen, it appeared that a copper uninsulated strip was run back from the engine-room to the house, which strip for a part of its run was enclosed in the same bitumen trough as the positive insulated main. There was no evidence of the strip having been properly connected to earth in the engine-house. A measurement of resistance to earth of this nominally "earthed" return was taken; and it showed as high a resistance as 8 ohms. Moreover, the potential of the ground immediately surrounding the engine-house was distinctly above that of the nominally earthed return main, but again not amounting to more than 0·2 volt.

Up to this point, the electrical engineers reported that the results obtained indicated a slight positive leakage round the engine-house which occurred when the installation was completely cut off and no current was passing through the mains, and was due to the creeping from the battery; and they did not consider that they had obtained sufficient evidence of a leak to account for the electrolysis. It, therefore, became necessary to seek for some other source of leakage; and the high resistance between the nominally earthed return and the earth itself seemed to indicate the direction of the leak. A test was then made with the house installation connected on, and a current of 30 amperes passing through the mains, when immediately an electromotive force was detected between the earth return and the water-pipe running to the house of 1·8 volts, which, in the engineers' opinion, accounted for the whole trouble which had occurred. They observed also that it is almost impossible to eliminate small leakages through the battery; and also they expressed an opinion that they did not think them harmful.

On the discovery of the escape of the 1·8 volts of electricity into the lead pipe, the author communicated the fact to Messrs. Ogston and Moore; and they immediately instituted a further series of experiments—causing an electric current of 1·8 volts to pass through the water in a lead pipe. On testing, it was found to contain 0·07 grain of lead per gallon. Two tests were made—in one case the current was allowed to pass through the water for the whole night, and in the other case for only four hours. In each case the amount of lead subsequently found in the water was identical; so that it was amply demonstrated that a current such as that which was shown to be leaking from the electrical installation in question is ample to produce cases of plumbism, and may seriously affect all persons using such water supply. It is therefore of the utmost importance that water engineers should have a knowledge of this fact; so that in the event of any case occurring within their own practice, they may be able to effectually deal with the subject.

Discussion.

Mr. C. E. JONES (Leyton) said he conceived this was one of the most important papers ever presented to the Association; and the thanks of the members were unquestionably due to the eminent Engineer who had taken the trouble to offer it for consideration. He (Mr. Jones) had read the paper over and over again; and he confessed that the more he read it, the more was he impressed with its far-reaching consequences. They, as water engineers, had probably paid too little attention to the question of lead in waters; and that of electrolysis had been raised before this and other Associations somewhat imperfectly. It had also been generally shelved by the electricians, on the ground that it was not proved that electrolysis did affect gas and water pipes. At that time, nobody seemed to fully appreciate what it all meant—that, when gas-pipes composed of iron were attacked gas escaped,

and formed an explosive mixture, endangering life and limb; while from water-pipes water escaped and was likely to deprive whole districts of their needful supply of water. Now they had got farther, and here, upon the most conclusive authority, upon fact piled upon fact (which no one could get away from), they had an instance of electrolysis taking place, attacking lead services, and producing lead-poisoning, which was a most horrible danger, and the effect of which could not be over-rated. He wished that Mr. Latham had only made more of this point. Lead was a most dangerous substance to be found in water. It had caused plumbism by the mere washing of a child in water which had been impregnated by lead. There was a case recorded of an infant being so washed, and shortly afterwards was paralyzed. A case also occurred some years ago to the Royal Family of France, in which 1 grain of lead per gallon caused 40 persons to be seriously affected, thirteen of whom manifested the blue mark across the fingers and toes. There were other dangerous symptoms, but fortunately in that case no fatality resulted. Thus they saw how serious was the question that had been raised in the paper, and how necessary it was that water engineers should extend their knowledge not only to the hydraulics of the question, but to its chemistry; and now to the electrical side. He took it that the purer that water was, the more liable was it to take up lead compounds, and become contaminated. This was a chemical fact known to everyone who had the slightest acquaintance with the subject. He asked the author of the paper whether it was known that warm water would absorb these compounds to a greater extent than cold water—whether it was not possible that, at the point of contact with the water, the temperature of the latter was raised a little; and therefore took up more lead than water in its ordinary state would have done. He thought this water must have been so highly charged with lead compounds, that there must have been an increase of the temperature of the water at the point where it was heavily saturated with lead. He was very much afraid that many of the cases of lead-poisoning were often referred to other causes by medical men. He did not bring any charge against them; but he should think there was more danger of lead-poisoning than had hitherto been thought. He had had the honour of being a Chairman of a Poor Law Board; and on the Board they had the Rural Sanitary Authority—that was, a separate Committee who dealt with the water supply to the rural parishes. They were short of water; and they were that day—in fact, the whole district was short of water except one portion of it. They went to the moors; and the whole of the people in the district were affected by lead-poisoning. The water contained vegetable acids, which were difficult to define, and were difficult to chemically arrest. There was no doubt that these vegetable acids decomposed the lead, and carried it forward to the consumers' taps. He had made experiments with water of various degrees of hardness; and with water of over 4° of hardness, he did not think that there was any danger whatever, or probability that the water would absorb any portion of lead.

Mr. W. H. Humphreys (York) agreed with Mr. Jones that this paper was one of the most important that had ever been presented to the Association. It had opened their eyes to a danger which he had never conceived. In fact, it might be in the recollection of the members that three or four years ago he read a paper on the question of electrolysis, and then made reference to electrolytic action on iron pipes; but it never occurred to him that a thing of this sort was likely to take place in lead pipes. In cities and towns where electric trams were working, and they were adopting the earth as a return current, it was a problematical thing as to what was happening to the water supply in those places. By the condition in which he had found certain pipes, he knew that electrical current was acting upon iron pipes. But here these small currents having had the effect of depositing carbonate of lead on the interior of the lead pipes, and having actually poisoned a man, he was really wondering what was happening elsewhere. Dr. Houston, of the Local Government Board, had prepared two huge volumes on plumbism in connection with the watersheds of Yorkshire and Lancashire more specially; and it appeared to him (Mr. Humphreys) that the subject of this paper was one to which they might call the attention of the Local Government Board, as being of equal importance—perhaps more important—for them to know what was going on. If Dr. Houston would go a little further in his investigations, and ascertain whether this action which Mr. Latham had mentioned was occurring elsewhere, they (water engineers) could do something in their own way to see if anything was happening in their cities and towns. He should certainly do something himself.

Mr. W. G. Peirce (Richmond) introduced to the members some samples of lead pipes, which he said confirmed the case of the destruction of lead service-pipes by escapes of current from electric cables. He had occasion to open the ground on Richmond Hill to repair the services; and he found about half-a-dozen of them all being damaged by the leakage of electricity from electric light mains. One of the pipes that he had brought to the meeting showed an opening clean through. They had, however, heard nothing about lead-poisoning. The pipes had been cut out in six different places. Some of the new pipes were pitted all over. At Canterbury, he had charge of the water supply for about nine years, and the whole of the water was softened by Dr. Clark's process. The only case of lead-poisoning he heard of there was in connection with a lead cistern on the water-works. They reduced the hardness to about 4°; and this was the only case he had knowledge of in connection with the Canterbury Water-Works.

Mr. E. J. Silcock (Leeds) also thanked Mr. Latham for having brought to notice what might ultimately turn out to be a very great danger. There was one feature in the case, however, to which he should like to call attention—that was, the very unusual arrangement of the electric mains. It appeared from the description given in the paper that the electric light mains had an earth return. He did not know when this particular installation was made. It must have been many years ago, because the modern practice was to have on all electric light installations a metallic return. He doubted whether they would get an insurance on a building which was wired in the way suggested. He would ask Mr. Latham to give them the information in his reply as to how the connection was made between the wires in the house and the earth at that end. The author had told them what happened at the dynamo end of the return; but not what took place at the other end of the return? It used to be a common practice to have electric bells rigged up by making a connection through the water-pipes; and it was quite on the cards that this electric installation had been put up by some working plumber, and that he had made a return connection from the house in the same way that he would do a bell connection. In such case the connection between the pipes and the wires would be a direct one; and it might be at a point where it would affect the water going to these cottages without affecting the water going to the houses. He also asked whether the two cottages were lighted by electricity, and, if so, how the electric light wires were connected in these cases. Of course, in towns where there were electric trams, they had the possibility of this danger taking place; but the Board of Trade regulations with regard to electric trams made it imperative that all rails should be used as a return circuit, and that all the rails should be electrically bonded; so that there was always an electric return apart from any earth return. The rails were in contact with the earth, and so there was a small earth return in all tramway systems. But still it was not such a direct connection as there used to be before the bonding took place, and before the danger of electrolysis was understood.

Mr. Easton Devonshire (London) said, regarding the effect of the escape of electricity, a case occurred last year or the year before on the Antwerp Water Company's system. They had a connection-pipe burst; and it was repaired in the early part of the year. At the time, no particular notice was taken as to the condition of the pipe. It was cut out; and before the end of the year, another burst occurred. Then, when the pipe was taken out, it was found to be pitted all over with holes; and it was discovered to be due to the escape of electricity. He entirely agreed with Mr. Humphreys that they should, as a body, consider what steps should be taken to put the matter in a serious form before the Local Government Board. He might tell the members indirectly that their Engineers knew of this. His Company—the South Hants Company—took the matter up, as they saw how important it was likely to be. They called in Messrs. Lucas and Pyke; and they had thoroughly investigated the whole matter. The Company would like to put into the possession of the Association the official report (which would be a full answer to the questions of the last speaker, as to all the circumstances under which this occurred), if the members thought it of sufficient importance. He should like to formally propose that this matter should be brought officially by the Association before the Local Government Board.

Mr. Peirce added to his previous remarks that since these difficulties had been met with, the cables had been placed under the lead service-pipes instead of over the top. The cables were also now encased in lead. The coating of the old cables they noticed was rotting. It was, in fact, completely decomposed, and caused the leakage which affected the pipes in the district in the way he had mentioned.

Mr. Humphreys seconded Mr. Devonshire's motion. He remarked that one point had been overlooked in the discussion. He believed the whole of the return currents of the National Telephone Company were obtained by connecting the return wire with the nearest water-pipe.

Mr. Latham said he had no doubt there were a great many instances of this.

Mr. Humphreys said the Post Office telephones had a proper return wire; and they did not work on the earth system. What was the effect of these thousands upon thousands of National telephones connected with the nearest water-pipes? He thought there was great danger in it.

Mr. S. R. Lowcock (London) thought the paper was valuable because it gave the members actual definite results, and definite causes which produced these results. They had been quarrelling with electrical engineers for a good many years; but nothing definite had ever been brought forward to show actually what results were produced by certain causes. He should like to ask Mr. Latham if he would be good enough to give the members a little more information as to what the current was that produced this result. He (Mr. Latham) said that the test was made with 30 amperes passing through the mains; and it would be well to know what the working pressure was at which the lighting was done—whether it was 60, 100, or 200 volts. The drop of voltage between the pipe and the earth showed the difference was 1·8 volts. That was the measure of pressure; and was not the measure of quantity at all. What they wanted to know was the quantity,

because electrolysis of water or metals depended almost entirely upon the quantity—it depended very little upon the voltage. A low voltage and large quantity would give them a good deal of electrolysis; but a high voltage and small quantity would produce very little. In connection with this, he did not think they need worry themselves very much about the effect of the telephone earth return, because the quantity was so small, and would not do any damage at all. Of course, the voltage was also low. In regard to the earthing of mains, a previous speaker seemed to have the impression that the whole of the current so taken was lost by the cable. They could not possibly send a current of 30 amperes back through the earth, because they would burn up everything with which they came in contact. It was not quite clear here what the earthing was; and he thought it was only an ordinary earthing.

Mr. DEVONSHIRE observed that it had been suggested to him that they ought to add the words, "Board of Trade" to his resolution as to sending a copy of the paper and the report of the Engineers to the Local Government Board. It certainly ought to get to the Chief Electrical Engineer of the Board (Col. A. P. Trotter).

Mr. C. H. PRIESTLEY (Cardiff), referring to the subject of lead-poisoning, said that in Cardiff they had moorland water, from which there had not been the slightest trace of lead-poisoning; whereas, in the North of England, nearly every town with a gathering-ground had had traces of it.

Mr. H. ASHTON HILL said he happened to live in the district of the Birmingham Corporation; and statements had appeared in the public Press of Birmingham recently as to the action of the new Welsh water upon galvanized kettles. On the instructions of the Medical Officer of Health, notices had been issued to the ironmongers and others who had sold these kettles asking them to use every endeavour to recall them, as the water had an effect upon the zinc of the galvanizing. This apparently was a very serious matter in the case of soft water; and really it looked as though one could only be absolutely safe by analyzing the water supply on his own premises.

Mr. GEORGE GREENSLADE (South Hants Water Company), pointing to two pieces of the affected pipes being exhibited to the members, said one piece was comparatively clean. It had got just a slight deposit on the inside, and had been in something like four or five years. This was about the time the electric installation was put in. The other was a piece of the pipe which led away from the electric station to the cottages, and this was a comparatively new one, having only been down about nine months. He thought the paper was a most valuable one for the Association; and he was delighted that Mr. Latham had brought it before the members. In Southampton, they had electric cables, and gas and water pipes all running within a few feet of each other; and he sometimes wondered what would happen. Dr. Roberts in this particular case was very strong on the matter; and he really thought the electricity was coming from Southampton. He came down to his (Mr. Greenslade's) office; and, on making a test, he found there was a mere sign of earthing—not so much as at Twyford. They were greatly indebted to Dr. Roberts for bringing this matter up, because it was a very serious one. He (Mr. Greenslade) would like to know what would have been the effect if, in this particular instance, it had been iron pipe instead of lead.

Mr. LATHAM, having expressed his acknowledgments to the various speakers, said, as to the exact condition of things in the house, they had no means of ascertaining that; but it was probable there was some connection made with the water-pipes, as well as with this direct main for water service. They were, however, interested in knowing that it was only the portion of the pipe after passing underneath the cable close to the electric light engine-house that had any effect in producing this particular case of plumbism. They were greatly indebted to Dr. Roberts for, at an early stage in his discovery of this case of lead-poisoning, his activity in the matter. It was not often they would find a country practitioner who would be so *au fait* with such a case as this as to find there was lead in the water. His action had resulted in investigations being carried out in the satisfactory manner explained by the Directors of the Company. This showed the advantage of a directorate, where they had only got to deal with a very few persons, who could make up their minds, and order work to be done at once, instead of having to go through some longer course through Committee, and to get the sanction of the Corporation before they could incur any expenditure. With regard to the question of temperature, he did not think the temperature itself at the point of contact could have had any effect, because the action evidently took place throughout the whole length of the pipe after passing the particular cable, or rather after leaving the engine-house. For a simple reason, he did not think it would be possible to raise the temperature of the water to a great extent, as they all knew that water varied in temperature throughout the year. Sometimes they got it down to very cool in the winter, and in the height of summer at a high temperature, owing to the fact that the temperature of the water was the temperature of the ground at the depth at which the mains were laid. Therefore the influence in the matter of temperature of the earth upon the water in a service of this kind was vastly greater than that of any small contact. There was no electricity in the cottages in which the case of plumbism occurred. What was observed was electricity from the electric light station.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by Correspondents.*]

Methods of Charging for Gas.

SIR,—In the course of reading the number of the "JOURNAL" for the 28th of November, I came to the humorous onslaught made (in the remarks with which he closed the discussion, at the recent meeting of the Manchester District Institution of Gas Engineers, upon the subject of the price at which coal gas should be sold for power purposes) by Mr. Thomas Newbigging upon the principle of the method of charging for gas which I advocate. It is highly flattering to have so much attention devoted by such an authority on gas matters to anything one has written, no matter what form this attention takes. But still one does not like to be misunderstood and misquoted; and, according to your report of Mr. Newbigging's remarks, he did both in this case. There is nothing in my paper on "Methods of Charging for Gas" that will bear out the latter part of the statement that is said to be quoted in my own words as follows: "As, under this scheme, the price paid is reduced as the consumption increases, you need only consume a large quantity of gas to pay nothing at all."* Neither does the paper advocate a reduction of prices based merely upon a large consumption. In referring to the application of the system in one particular town, I do say that the price paid for gas is reduced automatically as the quantity consumed increases; but the whole argument of the paper shows that this applies only to particular cases, and that one consumer may pay more than another for a given quantity of gas because of differences in the conditions under which the supply of gas is taken.

The underlying thought in Mr. Newbigging's paper seems to be that it is wrong to favour any one consumer, or class of consumers, at the expense of the others. I am entirely in accord with this sentiment, and with that expressed in the statement in his letter that "to do right between man and man can never be an out-of-date policy." But justice between consumers cannot be provided by the method of charging merely a certain price per 1000 cubic feet of gas with discounts based solely upon the quantity consumed. Every gas company in the United States that has made a careful analysis of the accounts of its consumers and the cost of carrying on its business has found that, under this method of charging, it is actually losing money on at least 20 per cent. of its consumers, and would be better off if it did not have them. So many of the expenses involved in serving a consumer are entirely independent of the quantity of the gas consumed by him, that it is impossible to make each consumer pay his share (and no more than his share) of the profit, unless part of the payment for the service is made independent of the quantity of the gas consumed. The consumer who requires a large service and meter, because, when he uses gas he does so at a rapid rate, but whose demand comes only for a comparatively few hours every year, is certainly more expensive than one who, using a small amount per hour for a great number of hours, consumes the same quantity with a much less expensive installation; and the former should be made to pay something for his service, if we are to do right between man and man.

As far as I can see, the only way in which every consumer can be made to pay his proper share of the expenses and profit, is by making each pay separately for the cost of taking care of his business, as determined by the conditions under which he uses gas; and after that make him pay for the gas used at a price per 1000 cubic feet which will be uniform for all purposes and whatever the size of the consumption. Under the present method of charging, the consumers who use a large amount of gas in proportion to the sizes of the installations required to serve them not only pay practically all the profit earned by the Company, but also make up the loss incurred on the business of the unprofitable consumers who require installations large in proportion to the amounts of gas used. There is no more justice in selling to the small consumer at less than the actual cost than there is in doing the same thing for the large consumer.

Mr. Newbigging is very solicitous as to the hardship that would be suffered by the "poor" consumer under the proposed method of charging. The poor man is not always the small consumer; and therefore he would not be as much affected by the proposed method of charging as is usually assumed to be the case. But even if he were, we should be just to all consumers, and not levy an extra assessment upon one class in order to make gifts to another class. I shall be very much obliged to Mr. Newbigging if he will show me how this can be avoided when the only charge made is one of a certain amount per 1000 cubic feet of gas consumed with discounts based solely on the quantity used, because I have been unable to find any such solution through my own study of the problem.

ALFRED E. FORSTALL.

New York, Dec. 12, 1905.

* The misquotation referred to arose through an accidental misplacement of the quotation marks, for which an apology was made in the succeeding issue of the "JOURNAL."—ED.J.G.L.

Water Gas "Smells" at Oldham.—On the discussion of the Gas Committee's minutes, Mr. Ashworth, one of the members of the Oldham Borough Council, complained of the very bad smells in the neighbourhood of the Hollinwood Gas-Works, which he said he was sorry to have continually to bring before the notice of the Council. Alderman Hanson said Mr. Ashworth had been very ingenious in finding fault with the making of water gas at Hollinwood; but it was the first complaint they had had for a long time. He thought the dissatisfaction arose from confusion in the minds of people who perhaps did not know the difference between coal and water gas. Where there was gas making, there would be smells; but the Committee had done everything they could to prevent the nuisance.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

(*Before Mr. Justice* BRAY.)

Thursday, Dec. 21.

Fletcher v. Mayor, Aldermen, and Burgesses of Birkenhead.

This was an action brought to recover the sum of £1200 and costs, as compensation for injurious affection to certain land, dwelling-house, and premises. The admitted facts in the case were as follows: Under the Birkenhead Corporation Gas and Water Act, 1881, defendants acquired a piece of land at Fordbridge, and had sunk thereon a well or borehole distant about 180 yards from the plaintiff's dwelling-house, and prior to November, 1904, had been pumping large quantities of water. The plaintiff alleged that, as the result of the pumping, large quantities of silt had been extracted from under his land, and a settlement had been caused owing to the support being withdrawn, and great damage had been done to the house. In consequence of this, on Nov. 18, 1904, he made a claim against the defendants for injurious affection, desiring that the amount of compensation should be decided by arbitration; and he appointed an Arbitrator. The defendants denied that he was entitled to any compensation, and appointed their Arbitrator under protest. The Arbitrators differing, Mr. Charles Gott was appointed Umpire. During the course of the arbitration, a point of law was raised that the plaintiff was not entitled to any compensation, even if his house was damaged in the way suggested. The Umpire found as follows: (1) That the Corporation had caused damage to the property of the plaintiff; that such damage was not occasioned by the abstraction of water only, but by the abstraction of water which carried with it silt from under the plaintiff's premises; that the weight of the buildings on the land had not caused the damage; and that the amount of the damage done to the plaintiff's property was £1200. The case was tried at the Liverpool Assizes, when it was agreed that a further question should be put to the Umpire by the learned Judge. This he answered as follows: "The subsoil which lay directly under, and formed the support of, the plaintiff's land, was a bed of wet running silt, which was drawn away by the pumping of the Corporation." His Lordship reserved judgment, which was delivered on the above-named day.

Mr. LESLIE SCOTT appeared for the plaintiff; Mr. HORRIDGE, K.C., and Mr. F. E. SMITH represented the defendants.

Justice BRAY stated the facts as above set forth, and then said the contention of the plaintiff was that the defendants had been authorized by section 12 of the Water-Works Clauses Act, which was incorporated with their Special Act, to take the water; that it was by the exercise of this power that the damage was done; that but for the authority conferred upon them by the Act the wrong would have been actionable, inasmuch as by it the plaintiff was deprived of the support of his house; and that sections 12 or 6 of the Act entitled him to compensation. The defendants contended that section 12 of the Act did not confer any power upon them, except to take water for the purposes of construction; that the water was not taken for this purpose, and therefore the section did not give any right to compensation; and that the power to take water after construction was impliedly given by the Special Act, section 20. To this the plaintiff replied that, if it was so given, he was entitled to compensation under section 6 of the Water-Works Clauses Act. The defendants further denied that the wrong would in any case have been actionable. Proceeding with his judgment, his Lordship said: I will consider the latter point first. It seems to me that any difficulty that existed is cleared away by the answer given to me by the Umpire. This finding brings the case exactly within *Jordeson v. Sutton, Southcoates, and Drypool Gas Company*,* which establishes that, but for the powers conferred upon them by Act of Parliament, the defendants would have been guilty of committing an actionable nuisance at common law, entitling the plaintiff to damages. I must, therefore, hold that the plaintiff's land and dwelling-house were injuriously affected. I will now consider section 12 of the Water-Works Clauses Act, 1847, in order to see if compensation is given for the injurious affection. The object of the Act was to provide general clauses which should be applicable to every case where it was proposed to confer power on promoters to construct water-works and supply water. One of the provisions which would be necessary was to give the promoters power to obtain water; and one would naturally expect to find in the Act a general clause giving this power. If it cannot be found in section 12, it does not exist. [His Lordship quoted the entire section.] If the words of the section are looked at alone, they are perfectly plain, and give the power that one would expect; but it is contended that the general words at the head of the section, "may execute any of the following works for constructing the water-works," show that the power must be limited to taking water for the construction of the works. Now, it is an established rule of construction of Acts of Parliament that the effect of words perfectly clear in themselves will not be limited by general words in a preamble; and I think the rule applies equally to the heading of a section such as this. But when the matter is further looked into, it appears still more plain. The quantity of the water required for the construction would be extremely small, and would do very little, if any, damage. Why should compensation be given for that, and not for the continued damage caused by the taking of large quantities of water? Then there are the words "from time to time." What did they mean if the power is only given during construction? There are the words, in the earlier part of the section, "divert and impound." Are the promoters only entitled to impound water in their reservoir during construction? This would be absurd. I think I am compelled to give to the words "from time to time . . . take such water as may be found in and under or on the lands to be taken for constructing the works" their natural and ordinary meaning; and that they gave to defendants the power to pump from their well or borehole in order to supply their district with water. If this be so, then, by the concluding words of the section, full compensation is given to all parties interested for all damage sustained by them through the exercise of this power. If I am wrong, and no such power is given, how did the defendants obtain their power? It was said for the defendants that their power was given them by section 20 of their Special Act, under the words, "the Corporation may make and maintain," &c. I will assume that this is so; then I have to consider section 6 of the Water-Works Clauses Act. This gives compensation for the lands injuriously affected by the construction and maintenance of the works by the Special Act authorized, or otherwise by the execution of the powers thereby conferred; and it seems to me that these words are quite wide enough to give compensation for damages caused by pumping, power to do which, by hypothesis, is given by the Special Act, whether under the words "make and maintain" or any others. His Lordship concluded by saying that, in his judgment, the plaintiff was entitled to recover the amount awarded, with interest at 4 per cent. from the date of the award, and also interest on the amount at which the costs should be taxed.

Mr. LESLIE SCOTT applied that costs should be on the higher scale, as a number of expert witnesses had to be called.

Justice BRAY said he would not exercise the power to order costs on the higher scale. If he did so, he would have to do so in every Lands Clauses case. In these cases the Master allowed very liberal charges.

On the application of defendants' Counsel, his Lordship gave leave to appeal.

* See "JOURNAL," Vol. LXXV., pp. 545, 1318.

Compensation for the Fatality at the Fulham Baths.

Readers may possibly remember that in the "JOURNAL" for Dec. 30, 1902, we reported a fatality at the Fulham Baths; two men having been killed by electric shocks while bathing the preceding Tuesday. The Corporation had to pay the representatives of the men £1173 as compensation; and a question arose as to whether the National Electric Construction Company were bound by contract to indemnify them. The matter was submitted to an Arbitrator; and it came before Mr. Justice Bigham in the form of a special case. By a contract dated June 5, 1901, entered into between the Corporation and the Company, the latter were to carry out the electric lighting and fitting at the public baths and washhouses on certain conditions—among others, that they should be responsible for injury caused by the works or workmen, and should hold the Corporation harmless in respect thereof; and that the work was to be carried out in accordance with the rules of the Phœnix Fire Office, which provide that when a system of metal tubes is employed, they are to be earthed, except in cases where earthing would not be desirable. The Arbitrator had found as facts that if the pipes had been earthed the accident would not have happened; but that, having regard to the state of knowledge among electrical engineers at the time of the contract, the omission to earth them did not indicate a want of reasonable care or skill on the part of the Company. With regard to the rules, earthing the pipes would not have been desirable so far as the risk of fire was concerned. His Lordship held that the only question was whether there had been a breach of contract. In his opinion there had not. The work was to be carried out in accordance with the existing rules of the Phœnix Fire Office. The Arbitrator had found as a fact that earthing the pipes would not have been desirable at the baths, so far as the risk of fire was concerned; and it followed that there had been no breach of the rules. He therefore gave judgment for the Company, with costs.

Joint-Stock Company Liquidations Last Year.

In the course of the past year, there were 1570 joint-stock companies compulsorily or voluntarily wound up or reconstructed, compared with 1550 in 1904. Among those reconstructed were the Economic Safety Gas Company and Messrs. Graham, Morton, and Co. The following were wound up voluntarily: Atmospheric Gas Company, Bath and District High-Level Water-Works Company, Dewey Lighting Syndicate, Electric Turbine Gas-Retort Charging and Discharging Machine Company, Empire Intensified Gas-Light Company, "H.C.L." Gas-Stove Company, Hedingham's Gas-Light Company, Helsby and District Water Company, Hollingbourne Gas Company, "Holophane," Kitson Incandescent Lighting Company of South Africa, Mickleover and Etwall Gaslight and Coke Company, Netherlands Incandescent Gaslight Company, New Export Incandescent Lighting Company, Rotary Meter Syndicate, Somersham Gas Company, Spanish Kern Burner Company, Voelker Incandescent Mantle Company.

Increased Gas Consumption in Manchester.

According to an article in the "Manchester Courier," the number of gas consumers in the city advanced last year by 5420, chiefly in those using prepayment meters. Gas-cookers have increased by 6900, and grillers by 2929. This involved the carbonizing of nearly 50,000 tons of coal, and the sale of about 100 million cubic feet of gas in the year. The consumption of gas from the 1st of April last to the 27th ult. went up to the extent of 183,726,000 cubic feet; being equal to more than 6 per cent., as compared with the small increase of 0·28 per cent. in the previous year. There were laid an additional 20 miles of mains and services during the year. For lighting the streets, there are 19,505 public lamps fixed in the city, and 7036 of them are on the incandescent system. The ordinary flat-flame burners have decreased by 2236; and the incandescents have increased by 2560. The greater demand for gas has been met by bringing into use, on the 27th of October, a portion of the first half of the new installation of inclined retorts at the Gaythorn station. When the entire installation is complete, it will have a producing capacity of 4½ million feet per 24 hours.

MISCELLANEOUS NEWS.

THE GAS QUESTION IN PARIS.

The Present Service to be Continued under Municipal Supervision.

In the last number of the "JOURNAL," we recorded the progress of events in connection with the gas supply of Paris down to the time of going to press. It may be remembered that the Budget Committee of the Municipal Council requested the Prefect of the Seine (M. de Selves) to submit to them a scheme for carrying on the undertaking of the Gas Company during the current year, reserving all the rights of the City in respect of the property. Accordingly, at the meeting of the Committee on the 22nd ult., he laid his suggestions before them. He proposed that the control of the gas supply during the present year should be entrusted to the Liquidators of the Company, under the supervision of the City. On their part, the Company no longer contested the right of the City to a share of the manufacturing and distributing plant; while with regard to the Company's portion, which was valued by them at 100,000,000 frs. (£4,000,000), but for which the City declined to give more than 80,000,000 frs. (£3,200,000), it could be paid for when convenient. In the event of no agreement being come to by the 1st of April next, the Prefect proposed that three experts should be nominated—one by the Company, another by the City, and the third by the Civil Tribunal of the Seine—to deal with the matter. It was decided to refer these proposals to the Gas Committee of the Council; and M. Chautard was chosen to bring up their report. The Committee had a sitting last Tuesday, and adopted a proposition, submitted by M. Grébauval, inviting the Prefect to endeavour to obtain legislative authority for the City to raise a loan for (*inter alia*) acquiring the portion of the undertaking—comprising the works, buildings, tools, &c.—belonging to the Company, in accordance with the arrangement submitted by the Prefect. M. Chautard announced that he had entered into negotiations with the Company's representatives, with the view of clearing up certain points in the scheme of M. de Selves, and of obtaining better terms both for the City and the consumers.

The negotiations referred to were brought to a close on Wednesday; and it was expected that M. Chautard's report would be distributed the next evening, in order that it might be discussed on Friday. An indication of its salient features was, however, given by an enterprising morning paper on Thursday. They are as follows: (1) As from Jan. 1, 1906, the *personnel* of the Company is to be assimilated to that of the City. (2) Consumers' deposits to be reduced from 7 frs. to 5 frs. per burner; the repayment of the difference to be made on April 1. (3) Abandonment of all pending legal proceedings by the Company on the signature of the agreement for the continuance of the service. (4) Recognition of the City as the owner of all the distributing plant on Jan. 1, 1906, and of the whole of the Company's assets on Jan. 1, 1907, subject only to the payment of the sum of 90,000,000 frs. (£3,600,000), instead of the 100,000,000 frs. demanded by the Company. (5) The remuneration of the Liquidators of the Company not to exceed 5,000,000 frs. in respect of the portion of the assets for which payment will not be made until 1907; and the Company's profits to be a like amount at the utmost—the rest to go to the City. (6) The price of gas to remain as at present—viz., 20 c. per cubic metre (equal to 4s. 6d. per 1000 cubic feet). The report did not come up for consideration till the afternoon sitting of the Committee on Saturday; and it occupied the members till half-past seven, when the discussion was suspended. It was resumed after the interval,, and at midnight the question was adjourned till the next day, when the report came before the Council at a public sitting, and, after a discussion on certain details, was unanimously adopted.

THE STEAM-ROLLER AND A GAS EXPLOSION.

Southampton Town Council Admit Liability.

Last May there was a disastrous gas explosion at the Northam Conservative Club, Southampton, by which two persons were injured and a lot of damage to property was occasioned. Owing to the conviction that the occurrence was due to the use of a steam-roller, claims were made on the Corporation by the Gas Company and the other sufferers. The Town Clerk was thereupon instructed to obtain Counsel's opinion on the matter; and at a recent adjourned meeting of the Council, the Works Committee reported that this had been done. The following were the actions pending against the Corporation: (1) The Gas Company, for injunction, damages, and costs; (2) Payne and another, for £552 damages to property, and costs; (3) Stutchbury for £176 damages to property and costs; (4) Bathard, for damages for amputated foot, &c., and costs; and (5) Dacre, for damages for broken leg, &c., and costs. The Works Committee having carefully considered the matter, recommended the Council: (1) To settle the Gas Company's action by paying the damages and costs, and giving an undertaking not to use or cause to be used any steam-roller in such a way as to fracture, damage, or injure the mains, pipes, or works of the Company properly laid. (2) To ascertain (as far as possible) the proper amount of damages in each of the other actions, and offer the same with costs, without prejudice; and in the event of the offer not being accepted, to pay the damages so ascertained into Court with an admission of liability. (3) To refer the question of ascertaining (as far as possible) the amount of the damages in each case to the Committee. (4) That the Borough Engineer be directed to discontinue the use of the 13¼-ton steam-roller, and to report generally upon the subject of steam-rollers. It was suggested that the Town Clerk should give some information about this matter; but Mr. Lewis said he could not see the use of discussion if members had read their minutes. Alderman Button remarked that it would be wise to take the Committee's report. They had gone very carefully into the matter; and the Council had the whole facts set out. Any discussion would be prejudicial rather than otherwise.

The report was thereupon adoped.

COST OF THE RICKMANSWORTH GAS-WORKS.

At a recent Meeting of the Rickmansworth Urban District Council, the Clerk (Mr. H. Lomas) submitted details of the cost of the gas-works, which, it will be remembered, were acquired from the Company a little more than a year ago, and with regard to which an active (and somewhat acrimonious) correspondence has lately been taking place in the columns of the local Press.

Mr. Lomas's statement was in the following terms:—

Amount of award	£24,500 0 0	
Add 10 per cent. for compulsory purchase	2,450 0 0	£26,950 0 0
Mortgages repaid by the Council		3,933 0 0
Bank overdraft repaid and to be repaid (Note.—This includes the sum of £1643 9s. 5d., costs of the Gas Company's Act of 1902, to be paid by the Council)		4,816 10 0
Value of stock and stores at the works on Sept. 30, 1904, as per valuation		890 10 0
		£36,590 0 0
The Company's taxed costs of the arbitration paid by the Council		£232 10 5
Costs of winding up the Company, not yet rendered, estimated at		50 0 0
Arbitrator's fees and expenses		293 12 3
The Council's costs of the arbitration, not yet taxed or ascertained, but estimated at		456 7 9
Costs of loan from Alliance Assurance Company		82 0 0
Costs of further loan		34 0 0
		£1,148 10 5

The two totals amount to £37,738 10s. 5d., which sum has to be repaid by instalments of principal and interest extending over a period of thirty years. This will involve an annual charge of £2138 11s. 4d. Of this amount, the sum of £36,000 has been raised by way of loan from the Alliance Assurance Company, at the rate of 3⅝ per cent. interest. The Council have also to pay their costs of the opposition to the Rickmansworth Gas Act of 1902, and the costs of their own Act of 1903, within a period of five years from the date of borrowing. These amounts are—

Taxed costs of opposition to Rickmansworth Gas Act, 1902	£580 5 4
The Council's costs of the 1903 Act (agreed at)	1,139 11 10
	£1,719 17 2

The repayment of principal and interest on the last-named sum of £1719 17s. 2d., over a period of five years, involves a charge of £400 a year, or thereabouts. Summarizing these annual charges, the result is that up to Dec. 8, 1905, the Council have to pay the sum of £2040 1s. 4d., instalments of principal and interest. For the next five years they will be called upon to pay an annual sum of about £2538 11s. 4d. for instalments of principal and interest; and at the end of this latter period, the liability of £400 per year to cover the costs and disbursements will cease, and the annual instalments be reduced to £2138 11s. 4d. I may take the opportunity to point out that it was only in the year 1903 that the Legislature for the first time imposed on local authorities an order for repaying the costs and disbursements incident to parliamentary procedure within so short a period as five years. In the case of a private company, this payment would be spread over a period of twenty years.

A further statement submitted by Mr. Lomas showed that, after deduction of principal repayment and interest, there was a surplus of £12 17s. on the half-year's working to March 31 last; the profit before such deduction having been £943.

THE FATAL GAS-WORKS ACCIDENT AT BIRMINGHAM.

An inquest was held last Friday week on the body of Joseph Matthews, a flue-cleaner, who (as briefly recorded in the "JOURNAL" for the 26th ult.) was killed by being caught on a coke-conveyor while following his employment at the Nechells Gas-Works of the Birmingham Corporation. The first witness, Mr. Walter Chaney, the Works Engineer, explained the working of the conveyor in question, which was set in motion by a hand-chain. He said that on the date of the accident, the deceased was engaged in cleaning out the flues. In order to get at the upper tiers, it was necessary to stand on a trestle, and put the rake into the flue either over the carrier or between the two parallel chains. There were printed regulations as to the starting of the conveyor; and orders were given that the men should not clean out the flues when the carrier was in motion. Matthews seemed to have disobeyed this injunction, and was caught by the chain and carried to the first couple of pulleys, where he was killed. The foreman bricklayer, under whom deceased worked, stated that he had never known any man to clean out the top tiers of flues while the conveyor was in motion; and orders that it should not be done had been given. A stoker named Kibler said that at 2.30 in the afternoon of the occurrence he saw Matthews get on his trestle; but he did not notice whether the conveyor was moving or not. About a minute afterwards, he shouted out, "Help," and witness, looking up, saw him hanging with his feet dangling in the air, while his neck and shoulders were caught against the pulley. Charles Woodward also saw deceased wedged with his chest over the shaft and the pulleys; and his head was thrown back, his chin having been caught by the girder. When released he appeared to be dead.

Evidence was next given as to the starting of the conveyor. A stoker named Lewis said that, at the time in question, it only moved 5 or 6 feet, and then stopped. As soon as it stopped, he heard shouts.

The conveyor on this occasion started between two draws; and he had never known this happen before. It stopped at 2.30. Albert Maskerry (who books the starting and stopping of the conveyor) stated that it stopped at 2.35 that afternoon, having started at 2 o'clock. Before starting, steps were always taken to see that everything was safe. He did not know of its going on again; he never gave any signal. The average time between the draws was about an hour; and the men cleaning the flues would be well acquained with this. Arthur Morby, engine-driver and conveyor attendant, said he had to start and stop the conveyors. He got the signal to start from the retort-house foreman; and he stopped without a signal when the draw was finished. He stopped the conveyor at 2.30 on the afternoon referred to. He did not start the conveyor again after it had stopped. He gave a signal to a man named Morris to turn a certain wheel; and when he did this, he saw another man named Woolard immediately turn to the chain. He did not, however, see Woolard touch anything. William Morris said that when he passed by the chain he saw Woolard standing about 3 feet away. Morby gave witness a signal which he could not understand; and he went on walking. He saw Woolard deliberately turn round and catch hold of the chain which started the conveyor in question. He could not say whether Woolard pulled the chain. Woolard was then called, and denied that he touched the chain. No one else could have pulled the chain without being seen by him. The Deputy Works Engineer, Mr. William Angus, said that he had tested the chain appliance to ascertain whether it could start or stop of itself. He found it took a pull equal to the weight of 43 lbs. to set the conveyor in motion. A pull of only 7 lbs. was required to move the belt on to the loose pulley—showing that the tendency of the belt was to run from the fast pulley to the loose one. When placed half-way over the fast pulley, the conveyor would not move; and it was impossible for it to start without someone pulling the chain with considerable force. It would not go of itself; and everything was in working order.

The City Coroner (Mr. Isaac Bradley), in summing up, remarked that he did not think they could find any other verdict than "Accidental death." It must be accidental death, unless they found that someone was criminally responsible for it. When they came to the evidence, there was a great deal established; and one point was not established, as they might think. There was no doubt about the conveyor having started again; and the only hint they had upon this was that, when it had been stopped, Woolard was standing near it. There was no one who said he saw him pull the chain; and he denied that he did so. It might be suggested to them that he was anxious to accommodate Morby. He (the Coroner) did not say he did it. There was nothing on the evidence to show that anyone was criminally responsible.

The Jury returned a verdict of "Accidental death," but thought some precaution ought to be taken in connection with the chain, so that it would be impossible for such a thing to occur again. Mr. Prideaux, who appeared for the Gas Committee, said they had courted the fullest inquiry; and if they could make assurance doubly sure, they would do so.

LIGHTING OF THE NEW CITY HALL, BELFAST.

Adoption of Incandescent Gas.

The subject of the lighting of the outside of the new City Hall, Belfast, has for some time been under the consideration of the Corporation; and opinions have necessarily been divided on the question of the illuminant to be employed. As the supply of both gas and electricity is in the hands of the Corporation, the chances for the adoption of either were about equal. In order to assist the authorities in coming to a decision, a deputation came over to this country for the purpose of inspecting the public lighting in the most important towns. In Scotland, Edinburgh, Glasgow, and Dundee were visited; and subsequently Newcastle, Liverpool, Manchester, Leeds, Birmingham, Leicester, London, and Brighton. This big tour, of course, afforded the deputation ample opportunity of seeing systems of artificial lighting, both with electricity and gas, in their most up-to-date forms. The result was that they decided to employ gas; and the James Keith and Blackman Company, Limited, have received an order for duplicated compressing plant, and the necessary lanterns, burners, &c. The plant consists of two No. 3 water-driven compressors of the "enclosed" pattern, each capable of compressing 500 cubic feet of gas per hour. It is understood that one is to be used for the outside lighting, and the other for such portions of the new hall as the Gas Department will occupy. The lanterns are all to be of the circular pattern, and the lighting and extinguishing will be automatically controlled by the opening and closing of one cock fixed near the compressor. There will be 25 lamps in all, 21 with burners of 300-candle power, and four with two 300-candle burners each. The lamps ordered will hardly be sufficient to make a really brilliant display of light; and possibly the Gas Department may at some future date double the number. However, in view of the very keen contest which has been going on during the last two or three years between the Electricity and Gas Departments to secure the lighting of the space around the new hall, it is satisfactory to record that it has resulted in another triumph for gas.

Electric Light Failure at Weston-super-Mare.—The well-known liability of the electric light to "fail" usually manifests itself at the most inconvenient moment. This was the case at Weston-super-Mare on the Saturday preceding Christmas, when the portion of the town that is rash enough to depend upon this form of lighting was suddenly plunged in darkness. One can imagine the feelings of the different shopkeepers, whose premises were at the time thronged with people anxious to spend their money. Perhaps the blessings which were doubtless showered upon the electric light undertaking had some effect, for, before the candles and lamps which were requisitioned could be brought into use, the current was restored. It is, however, safe to assume that by this time the tradesmen had had their confidence in electricity severely shaken.

OPERATIONS OF THE POWER GAS CORPORATION.

The Fifth Ordinary Meeting of the Power Gas Corporation, Limited (whose report was noticed in the "JOURNAL" for the 19th ult., p. 804), was held last Friday week, when the Chairman (Mr. Alfred Mond) went fully into the position and prospects of the undertaking. Referring to the resignation by Sir Henry Fowler of the position of Chairman, and by Mr. R. Seymour Benson of that of Managing Director to Messrs. Ashmore, Benson, Pease, and Co., he remarked that the Directors were pleased to be able to find a very able successor to the latter gentleman in Mr. T. Perronet Barker, who was formerly General Manager to Messrs. Thomas Piggott and Co. Unfortunately, owing to the shortage of turnover at the engineering works, the trading of Messrs. Ashmore, Benson, Pease, and Co. had resulted in a loss instead of a profit; but this did not appear in the accounts of the Corporation, as the two were kept entirely separate. The new General Manager had recently been in Egypt, where he succeeded in obtaining a very large and remunerative Government contract for the works at Stockton. The South Staffordshire Mond Gas Company's station had now been working for some months, and had fulfilled anticipations from an engineering point of view. There were a number of difficulties which had to be overcome after the plant was started; but they were really trifling compared with the magnitude of the scheme. The number of customers was on the increase; and therefore he saw no reason at all why, as time went on, and people got educated to the use of the gas—which naturally must be a somewhat lengthy process—the undertaking should not fulfil the expectations with which it was started. The Corporation were carrying on at the present time important negotiations with large and influential firms for installations of power-gas plant to a very heavy amount. Some of these had been going on for about three years; and at last a number of them appeared to be drawing to a successful conclusion. The Board had had a letter asking whether Mond gas, as a motive power, was being adopted. Well, when firms like Messrs. John Brown and Co., of Clydebank, and others of similar importance, were putting in installations, in order to run their huge shipbuilding yards with gas-engines driven by Mond gas, it was surely a little late in the day to inquire whether the Corporation's plant was being put in or not. The gas-engine had disappointed them; but he only heard that morning that in Germany one firm had no less than eight 4000-horse power gas-engines building; and when units of this kind were being built and run, it would very greatly facilitate the Corporation's business here in inducing central-station engineers to adopt their system, which was admitted to be the most economical power-producing system in the world for large generating stations.

The report was adopted after some questions had been answered; and then an alteration in the Articles of Association was agreed to—the Chairman remarking that, in view of the financial position of the Corporation, the Board felt it was only right that the fees to which they were entitled under the existing Articles should be reduced, and that their commission on profits should be somewhat increased.

CAPE TOWN WATER SUPPLY.

Inauguration of a New Reservoir.

We learn from "Engineering" that a new reservoir at Newlands, on the slopes of Table Mountain, has lately been completed by the Cape Town Suburban Municipal Water Board, from designs by Mr. J. M. Wright, Assoc.M.Inst.C.E. The reservoir was declared open by Colonel Crewe, the Colonial Secretary; and Mr. Earp, the Chairman of the Board, gave some particulars in regard to it. The reservoir is situated at an elevation of 450 feet above sea-level. Its length is 960 feet, its breadth 200 feet, and its area at the top water-level about 4½ acres. The depth of the reservoir is 28 feet from the floor to the top of the wall; and the depth of the water 25 feet. The capacity is 30 million gallons. The total quantity of excavation was about 220,000 cubic yards, all of which has gone into an embankment. The quantity of concrete used was 26,000 cubic yards, requiring 50,000 tons of broken stone, 20,000 tons of sand, and 36,000 casks of cement. The total cost has been £131,000. Mr. Earp said it was not a cheap reservoir, partly because it was built in a dear time, but mainly because, being on the slope of a mountain, the whole of the capacity had to be obtained by excavation. The cost works out at about £4360 per million gallons storage capacity. About seven years ago, the four Municipalities represented upon the Water Board realized that a considerable augmentation of the water supply was necessary, and it was a vain hope to look for it from Table Mountain. Accordingly, investigations were made beyond the limits of the Peninsula, which resulted in the purchase of Oliphant's Hoek and Steenbras River. The new reservoir has a certain value in addition to the part it is intended to take as a service reservoir for a large scheme. An old reservoir near has a capacity of only 750,000 gallons; and as there are certain springs and streams on the mountain slopes which run strongly after heavy rains, the old reservoir was too small for storing this water. The greatly increased size of the new reservoir meets this want; and it is anticipated that it will add about 200,000 gallons per day to the supply in the dry months of the year. The total daily quantity, therefore, in dry years will be, in round figures, about 1·3 million gallons, to serve a population of about 65,000. This represents 20 gallons per head; but it is felt that to supply the Cape Government railways, to enable a water-borne system of sewage to be introduced, to sufficiently water roads and gardens, and to provide for wash-houses and other municipal requirements, an adequate daily supply for a climate such as that of Cape Town must be taken at least at 35 gallons per head.

The output of gas at Belfast on the shortest day of the past year—the 21st ult.—was 9,904,000 cubic feet. This was a record; the previous highest figure having been 9,679,000 cubic feet, on Dec. 24, 1904.

ILKESTON AND HEANOR WATER SUPPLY.

The Works of the Joint Water Board.

We have already recorded the inauguration some months ago of the works constructed for the supply of the district of the Ilkeston and Heanor Joint Water Board. They were carried out by Messrs. G. & F. W. Hodson, MM.Inst.C.E., the Engineers to the Board, who have recently sent us a pamphlet containing an illustrated description of them, from which we extract the following particulars.

It was in 1900 that the Engineers were authorized to propound a scheme capable of affording an adequate supply of water in the districts of the two authorities constituting the Water Board; and in the result they recommended the purchase of the rights of the Meerbrook Sough Company and the promotion of a Bill for the acquisition of that source. An agreement was afterwards negotiated for buying out the Company at the price of £5000 and the costs of the transfer; and an Act of Parliament constituting the Board was passed the next year. At that time the population of Ilkeston was estimated at 25,000, and of Heanor at 16,000; and calculations based on the census records indicate that the figures will probably be doubled in 1941. Assuming the district is fully supplied with 25 gallons per head, the total quantity required is about a million gallons daily; and in 1941 it will approximate to two millions. The works have therefore been designed to supply a million gallons during a working day of ten hours, keeping in reserve a capacity of (say) an additional ten hours for meeting the requirements of the growing population.

The Meerbrook Sough is an underground adit or tunnel, commencing at the River Derwent in the eastern angle of Wirksworth parish, about ¾ mile north of Whatstandwell Bridge, and 3 miles south of Matlock Bath. The average daily discharge of the Sough is 17 million gallons; the minimum being about 14 and the maximum 19 millions. The tunnel at its mouth, and for 30 yards in length, is 10 feet wide and 7 feet high, after which it diminishes to about 6 feet wide. It is very substantially lined with stone masonry for the first 1000 feet, and is afterwards generally cut through the solid millstone grit rock until it reaches the well-known gulf fault of the Wirksworth district, except in a few places where soft materials are passed through, where it is lined with masonry. The total length of the various tunnels is approximately 5 miles, and they vary in depth below the surface from 700 feet, where it passes below the high ground separating the Wirksworth Valley from the Derwent Valley, to about 500 feet deep at Middleton, and 250 feet under Wirksworth. The tunnel is comparatively dry overhead, and the water rises up through the floor; and there appears to be no doubt that the bulk is derived from the millstone grit formation, although some portion—possibly about one-third—comes from the limestone, with the result that the total hardness of the water is about 15·4° on Clark's scale. But this hardness varies with the change of the seasons.

The pumping-station consists of a main engine-house, boiler-house, and coal-store, a centrifugal pumping-house, turbine-house, fitting-shop and oil-store, all in one block; the roof of the back range of buildings being formed by a large cast-iron tank, into which the supply is first pumped from the Sough for softening purposes. The softening plant consists of six large iron tanks, over which is placed the softening room, and underneath a brick reservoir to store the softened water ready for the main engines. Appurtenant to the softening tanks are the carbonating-house and a two-storey lime-store, fitted with a hydraulic hoist for lifting the lime to the working-stage. There is also on the site a pair of cottages for the resident engineers.

The turbine—a 60-inch Jonval—drives a Tangye centrifugal pump. The maximum available fall when the river is low is 6 feet, and its power varies with the height of the water in the river. It is at no time sufficient to pump the whole of the water required, but is useful in reducing the coal bill up to its capacity. To supplement the work performed by the turbine, there are two 10-inch centrifugal pumps (one to work and one as a stand-by), each capable of delivering 100,000 gallons of water per hour into the balancing and softening tanks. These pumps are direct driven by compound Archer type high-speed engines on the same bed-plate. The high-pressure cylinders are fitted with piston-valves, and the low pressure with slide-valves; and the engines usually work condensing into the main engine condensers. In the centrifugal house there are also a compound condensing vertical steam-engine working direct at 350 revolutions per minute, and a four-pole dynamo fixed on the same base as the engine. In connection with this plant, there are four arc lamps in the engine and boiler houses, five 100-candle power "Sunbeam" incandescent lights in the softening-room and centrifugal-house, 26 incandescent lamps and pendants, and 10 wall plugs fixed in convenient positions for attaching hand lamps for inspecting the machinery.

The main engine-house is 78 feet long by 28 feet wide, 26 ft. 6 in. high from the main floor to the tie-beam, or 33 feet to the ceiling. Beneath the main floor is a basement 14 ft. 6 in. deep for the pump foundations; and below this there is a thickness of 4 ft. 6 in. of concrete, reinforced by a series of steel joists constituting a gridiron, which was necessitated by the fact that the site had at some time been the ancient course of the River Derwent. The total height, therefore, from the foundation to the ceiling is 52 feet. The foundations of the machinery are a continuous block of cement brickwork running the entire length of the engine-house, 19 feet in width, coped with massive Whatstandwell stone to receive the bed-plates of the engines and pumps. All the buildings are faced with red sandstock bricks, have Darley Dale stone dressings, and are covered with red tiles. The chimney is octagonal, 110 feet high above the ground level, on a foundation 20 feet square, and it is 6 feet wide inside.

The main engines comprise three sets of vertical triple-expansion engines, having high-pressure cylinders 15 inches, intermediate-pressure cylinders 24 inches, and low-pressure cylinders 40 inches in diameter, with 33-inch stroke, running at 30 revolutions per minute; the piston and pump speed being 165 feet per minute. Each set is capable of delivering 50,000 gallons of water per hour into the Chadwick Nick reservoir, the total height, including friction, being about 500 feet. In ordinary working, two engines run together to deliver 2 million gallons in 20 hours—the third set being kept as a stand-by; but the pumping main is so proportioned as to permit of three sets being worked together if necessary. The cylinders are steam-jacketed, and the high-pressure cylinders are fitted with variable expansion gear adjustable when the engine is in motion. They are carried by cast-iron standards, and supported in front on bright steel pillars bolted down to massive bed-plates 3 ft. 4 in. deep at the back, and 2 ft. 3 in. deep at the front. Access to the upper part of the engine is obtained by two flights of stairs leading to two galleries with polished steel

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 23.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
590,000	10	Oct. 13	10½	Alliance & Dublin 10 p.c.	20—21	−½	5 0 0
160,000	10	,,	7½	Do. 7 p.c.	14⅜—15½	..	4 16 9
200,000	5	Nov. 15	7	Bombay, Ltd.	6⅞—7⅛	..	4 16 7
40,000	5	,,	7	Do. New, £4 paid	5—5⅛	..	5 1 10
50,000	10	Aug. 31	14	Bourne-mouth Gas and Water } 10 p.c.	29—30	..	4 13 4
51,810	10	,,	7	B 7 p.c.	17—18	..	3 17 9
53,200	10	,,	6	Pref. 6 p.c.	15⅛—16½	..	3 12 9
380,000	Stk.	Aug. 16	12½	Brentford Consolidated	260—265	..	4 14 4
300,000	,,	,,	9⅜	Do. New	197—202	..	4 14 1
50,000	,,	,,	5	Do. 5 p.c. Pref.	125—130	..	3 16 11
206,250	,,	Dec. 14	4	Do. 4 p.c. Deb.	101—104	..	3 16 11
220,000	Stk.	Sept 15	11½	Brighton & Hove Orig.	222—227	+2	4 19 1
246,320	,,	,,	8½	Do. A. Ord. Stk.	162—167	+2	4 18 10
460,000	20	Sept. 28	10	British	42½—43½	..	4 11 11
100,000	Stk.	Aug. 16	6	Bromley, Ord. 5 p.c.	121—124	+1	4 16 9
165,700	,,	,,	4½	Do. do. 3½ p.c.	91—94	+1	4 15 9
500,000	10	Oct. 13	7	Buenos Ayres (New) Ltd.	12¼—12⅝	..	5 9 10
250,000	Stk.	Dec. 29	4	Do. 4 p.c. Deb.	95—97*	+1	4 2 6
150,000	20	July 13	8½	Cagliari, Ltd.	24—26	..	6 6 11
100,000	10	Sept. 28	10	Cape Town & Dis., Ltd.	17—17½	..	5 14 3
100,000	10	Oct. 27	4½	Do. 4½ p.c Pref.	10—10½	..	4 5 9
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	52—54	..	5 11 1
50,000	Stk.	Dec. 29	4½	Do. 4½ p.c. Deb. Stk.	100—102*	..	4 8 3
1,434,680	Stk.	Aug. 31	5⅛	Commercial 4 p.c Stk.	116—118	..	4 8 1
560,000	,,	,,	5	Do. 3½ p.c. do.	112—114	..	4 7 9
450,000	,,	Dec. 14	3	Do. 3 p.c. Deb. Stk.	84—86	..	3 9 9
800,000	Stk.	,,	6½	Continental Union, Ltd.	126—129	..	5 0 9
200,000	,,	,,	7	Do. 7 p c Pref.	143—148	..	4 14 7
424,070	Stk.	—	5½	Derby Con. Stk.	125—127	..	4 6 8
55,000	,,	—	4	Do. Deb. Stk.	108—110	..	3 12 9
486,090	10	July 28	11	European, Ltd.	22—23	..	4 15 8
354,060	10	,,	11	Do. £7 10s. paid	15—16	..	5 3 2
15,223,235	Stk.	Aug. 16	4⅛	Gas-light and Coke } 4 p.c. Ord.	102—103	..	4 5 5
2,600,000	,,	,,	3½	3½ p.c. max.	89—91	..	3 16 11
3,799,735	,,	,,	4	4 p.c. Con. Pref.	110—112	..	3 11 5
4,193,975	,,	Dec. 14	3	3 p.c. Con. Deb.	86—88	..	3 8 2
258,740	Stk.	Sept. 15	5	Hastings & St. L. 3½ p.c.	101—103	+2	4 17 1
82,500	,,	,,	6½	Do. do. 5 p.c.	123—126‡	..	5 3 2
70,000	10	Oct. 13	11	Hongkong & China, Ltd.	19½—20½	..	5 7 4
3,800,000	Stk.	Nov. 15	10	Imperial Continental	233—235	..	4 5 1
473,600	Stk.	Aug. 16	3½	Do. 3½ p.c. Deb. Red.	96—98	..	3 11 5
175,242	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c.	123—128	..	4 13 9
561,000	Stk.	Aug. 16	10	Liverpool United A	237—239	..	4 3 8
718,100	Stk.	Aug. 16	7	Liverpool United B	172—174	..	4 0 6
306,083	,,	Dec. 29	4	L'rpool Unit'd Deb. Stk.	109—111*	..	3 12 1
75,000	5	Dec. 14	5	Malta & Medn., Ltd.	4¼—4⅜	..	5 5 3
560,000	100	Oct. 2	5	Met. of } 5 p.c. Deb.	100—102	..	4 18 0
250,000	100	,,	4½	Melbourne } 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	Nov. 15	3½	Monte Video, Ltd.	11½—12½	..	5 12 0
1,565,892	Stk.	July 29	4⅝	Newc'tle & G'tesh'd Con.	107—109	..	4 4 10
406,025	Stk.	Dec. 29	3½	Do. 3½ p.c. Deb.	98—100*	..	3 10 0
15,000	10	Aug. 31	10	North Middlesex 10 p.c.	18½—19½	..	5 2 7
52,940	10	,,	7	Do. 7 p.c.	13—14	..	5 0 0
300,000	Stk.	Nov. 30	8	Oriental, Ltd.	148—151	..	5 6 0
600,000	5	Sept. 14	7	Ottoman, Ltd.	6—6½	..	5 7 8
398,490	5	Apl. 28	6	Primitiva Ord.	7—7½	..	4 0 0
796,980	5	July 28	5	Do. 5 p.c. Pref.	5⅛—5⅜	..	4 13 0
488,900	100	Dec. 1	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
851,070	10	Oct. 13	7	River Plate Ord.	12¾—13¼	..	5 5 8
300,000	Stk.	Dec. 29	4	Do. 4 p.c. Deb.	95—97*	+1	4 2 6
250,000	10	Sept. 28	7	San Paulo, Ltd.	13—13½	..	5 3 8
70,000	50	July 1	5	Do. 5 p.c. Deb.	51—53	..	4 14 4
135,000	Stk.	Sept. 14	10	Sheffield A	244—246	..	4 1 4
209,984	,,	,,	10	Do. B	244—246	..	4 1 4
523,498	,,	,,	10	Do. C	244—246	..	4 1 4
126,106	Stk.	Aug. 31	5½	Shrewsbury Ord. 5 p.c.	110—120	..	4 11 8
70,000	10	Sept. 28	10	South African	15½—16½	..	6 1 3
6,250,000	Stk.	Aug. 16	5½	South Met., 4 p.c. Ord.	132—134	..	4 2 1
1,895,445	,,	July 13	3	Do. 3 p.c. Deb.	87—89	..	3 7 5
575,000	Stk.	Aug. 16	5½	S'th Suburb'n Ord. 5 p.c.	123—126	..	4 7 4
60,000	,,	,,	5	Do. 5 p.c. Pref.	125—130	..	3 16 11
112,533	,,	July 13	5	Do. 5 p.c. Deb. Stk.	132—137	..	3 13 0
502,310	Stk.	Nov. 15	5	Southampton Ord.	109—112	..	4 9 3
120,000	Stk.	Aug. 31	6¼	Tottenham } A 5 p.c.	125—128	..	4 17 8
363,020	,,	,,	4½	and } B 3½ p.c.	99—102	..	4 13 2
125,000	,,	Dec. 14	4	Edmonton } 4 p.c. Deb.	105—107	..	3 14 9
182,380	10	Dec. 29	8	Tuscan, Ltd.	9½—10*	..	8 0 0
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	100—102	..	4 18 0
30,000	Stk.	Aug. 16	7½	Wands-worth } A 5 p.c.	—	..	—
255,636	,,	,,	6¼	B 3½ p.c.	137—140	..	4 9 3
60,000	,,	,,	5⅛	and } C 3½ p.c.	113—116	..	4 13 6
57,564	,,	Dec. 29	3	Putney } 3 p.c. Deb. Stk.	80—83*	..	3 12 3
745,872	,,	Aug. 16	5	West Ham 5 p.c. Ord.	106—108	..	4 12 7
185,000	,,	,,	5	Do. 5 p.c. Pref.	123—126	..	3 19 4
193,300	,,	Dec. 29	4	Do. 4 p.c. Deb. Stk.	102—107*	..	3 14 9

Prices marked * are "Ex. div."

handrails, which run the whole length of the engine-house, one on either side of the cylinders. The fly-wheels are 12 ft. 6 in. in diameter and 10 inches on the face; and the air-pumps are driven off the end of the main crank-shafts. Each engine is fitted with a feed-pump worked by an eccentric from the main engine crank-shaft, and there is also a separate horizontal donkey feed-pump for feeding the boilers when the engines are at rest. Each engine drives a set of three-throw ram pumps placed immediately under each cylinder, and driven direct from the piston-rod cross-head by slide-rods connected to the pump cross-heads. The pumps have polished gun-metal rams 10¼ inches in diameter, with a stroke of 33 inches; and the stuffing-boxes have gun-metal neck bushes.

The boiler-house is 48 ft. 6 in. long and 33 ft. 6 in. wide, and contains three Lancashire boilers, 28 feet long and 7 ft. 6 in. diameter, suitable for a working steam pressure of 130 lbs. to the square inch. Two of the boilers are of ample capacity for driving all the plant and providing the steam required in the softening process, the third boiler being kept as a stand-by. All the boilers and steam-pipes are covered with magnesia lagging. Adjacent to the boiler-house is the coal-store, 37 ft. 6 in. long and 20 feet wide; and a tramway has been laid down from the Midland Railway for bringing the coal and lime on to the works. The fitting-shop, 28 feet long by 19 feet wide, paved with wood blocks, is provided with a 6-inch screw-cutting and surfacing lathe and bench drilling-machine, both driven by a line of shafting in connection with the turbine. There is also a blacksmith's forge and fitting-bench, and a cupboard for stores.

The softening apparatus comprises a balancing tank 81 feet long by 21 feet wide and 7 ft. 6 in. deep, with a working capacity of 75,000 gallons. This is provided to receive the water from the centrifugal and turbine pumps, which are run continuously, and at the same time enable the softening tanks, which take their supply intermittently, to be filled at a much quicker rate. The softening tanks are oblong in form, 108 feet long and 72 feet wide, divided by partitions into six tanks, each 36 feet square and 11 ft. 6 in. deep. They have a combined capacity of 500,000 gallons; the working capacity of each tank being 64,800 gallons. Both these and the balancing tank are formed of cast-iron plates with 3¼-inch planed flanges, bolted together with ⅞-inch bolts 6 inches apart. The cast-iron tanks are carried on girders over the softened water reservoir, which is built of brickwork in cement, and contains 252,000 gallons. On top of the softening tanks is the softening-room, 14 feet wide and the full length of the tanks. In this room are arranged all the valves and apparatus for working the Archbutt-Deeley process. The whole plant is designed to soften 100,000 gallons of water per hour, to correspond with the capacity of two of the main engines.

The pumping-main from the engine-house to the Chadwick Nick reservoir is 18 inches diameter, and is laid in concrete under the bed of the River Derwent and under the Cromford Canal; the pipes in both these cases being specially strong hydraulic-jointed pipes, 1⅞ inches thick. There are three large retaining-valves, with multiple doors fitted with bye-passes, to guard against damage in case of accidents; and there are three wash-outs fixed for cleansing purposes or to empty the mains when required.

The Chadwick Nick reservoir is 700 feet above Ordnance datum, and is 150 feet long by 100 feet wide, with a working depth of 16 feet. It is excavated out of the millstone grit rock, which was ground up and formed an excellent concrete material, of which all the walls and floor were constructed. It is divided by a concrete cross wall, 10 feet high, into two compartments, to enable one part to be cleansed while the other is kept in work. The reservoir is covered by a one-ring blue brick arch and concrete; the arches being supported by blue brick piers. The water descends into the bottom of the reservoir, and is decanted out from the top by two floating arms into the gravitation main. The reservoir is fitted with an electrical apparatus which records on a diagram in the engine-house every inch of rise and fall of the water, and at the same time indicates in the Ilkeston and Heanor Town Halls the exact height of the water at the moment. The gravitation main from this reservoir is 15 inches diameter, and passes across the Amber at Bullbridge, and *viâ* Ripley Market Place, through Codnor and Loscoe to Heanor, where it is reduced to 14 inches, and then goes on to the Ilkeston reservoir. At Codnor Gate a 10-inch main is carried to the new Codnor reservoir, which is situated at the highest point in the Heanor district. At Heanor a junction has been made into the old pumping-main from the Bailey Brook Colliery, to deliver water into the Tag Hill reservoir, which is intended in future to serve the low-level district of Langley Mill.

The Ilkeston reservoir is built on land adjoining the old Ilkeston reservoir, and its top water-level is exactly the same—viz., 382 feet above Ordnance datum; and pipes have been arranged so that they can be worked either together or separately. A pressure-reducing valve has also been fixed so that the pressure may be increased when found to be necessary in the higher parts of Ilkeston. This reservoir is circular, 105 feet in diameter, with a working depth of 15 ft. 6 in., and is constructed of brickwork in cement. It is lined throughout with blue bricks, and massive buttresses and special arched construction have been introduced; and to protect it as far as possible from any danger from mining operations, the walls and piers have been built upon a foundation of clay puddle, which has been carried up outside the walls above the top water-line. A new 12-inch main has been laid from this reservoir, and is coupled up to the existing 12-inch main in the town of Ilkeston. The Codnor reservoir is also circular, 75 feet in diameter, with a working depth of 15 ft. 6 in. The top water-line is 489 feet above Ordnance datum, which will give an effective high-level pressure at Heanor. This reservoir is built of brickwork in cement and the internal walls and piers and the floor are all faced with blue bricks. To protect it as far as possible from future mining operations, it is built on a bed of clay puddle, in the same manner as the Ilkeston reservoir, which it very much resembles. Valve-houses have been built over both reservoirs, which give ready access for convenient working, and for the reception of the telephonic apparatus.

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NEW WORK
1906.

Now is the time to get Particulars of our Patent Inclined Retort-Bench, which costs about **20 per cent. less** than the old design and is equally effective. We can arrange to work it in your existing House without raising the Roof.

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12 YEARS' Experience in actual building of Benches.

16 YEARS' in Manufacture of Conveyors and Elevators for same.

33 CONTRACTS COMPLETED.

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SPECIALITIES:

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Grit-Proof Bearings.

No Gas-Works is complete unless the above are in use.

NEW CONVEYOR Co., LTD., SMETHWICK.

At each of the three reservoirs into which water is delivered by the Board there are fixed nests of two or three of Kent's uniform "Positive" water-meters, which are controlled by sluice-valves, so that any one of the meters can be taken out for examination and repair without interfering with the supply to the districts.

From the Codnor reservoir an independent 12-inch distributing-main has been laid by the Heanor Council, partly in the same trench as the 15-inch gravitation-main belonging to the Water Board; and out of this 12-inch main new distributing-pipes have been laid throughout all the streets in Codnor and Loscoe, two wards of the Heanor urban district, which previously had no public water supply. The 12-inch main is also coupled up to the existing mains at Heanor, so that the future supply to all the high-level districts will be taken direct from the Codnor reservoir.

It is subdivided by non-return valves wherever practicable, so as to retain the water in the mains at the high levels if accidents occur to the pipes in the low levels. Sluice-valves are placed at intervals, and all of them are fitted with small bye-passes, so that the mains can be slowly recharged; and air-valves and wash-outs have also been provided at all suitable and necessary points. There are six different thicknesses of metal in the pipes, varying from 1 inch down to $\frac{5}{8}$ inch, in proportion to the pressure they have to bear; and on all the river, canal, and railway crossings specially thick flanged pipes, chiefly with hydraulic joints, are used. The Board's gravitation mains are all calculated to deliver the full daily supply in 20 hours, and are so proportioned, after taking account of the friction of the water through them, that, assuming the reservoir valves are all left full open, the estimated proportion of the water required for each district will be automatically delivered.

The estimate of the total cost to the Water Board and the Ilkeston and Heanor Authorities, including the purchase of the rights of the Meerbrook Sough Company, all lands, easements, and compensations, and the construction of the works, was £134,000.

THE DRY WEATHER OF THE PAST MONTH.

The last month of the year just closed established a record for dry weather. Writing to "The Times" on the 24th ult., from the rainfall station in Camden Square, Dr. H. R. Mill said that at nine o'clock that morning 15 consecutive dry days had been recorded; thus establishing what is technically known as "an absolute drought." Such a drought occurs, on an average, once a year in London; but since observations were commenced at Camden Square, by the late Mr. G. J. Symons, in 1858, so many as 15 consecutive dry days have only once before occurred in the month of December. The former occasion was in 1892, when no rain fell after the 15th of the month. The weather at that time was intensely cold, with hard frost, much bright sunshine, a little fog, and a barometer only slightly above the average; in contrast with which we had, on the day Dr. Mill wrote, just come through a fortnight of mild and equable weather, nearly sunless, with dense fogs and an extremely high barometer. He thought the facts were sufficiently unusual to be placed on record. To the 15 days mentioned by him, three more—the 24th to the 26th—have to be added; making 18 days in all. The drought broke on Thursday; but up to the evening of that day there had only been half-an-inch of rain during the month. Though Dr. Mill's records give the palm to last month as the driest December of the past half century, those at Greenwich show that in the corresponding month in 1873 the rainfall was only 0·31 inch; and that during the whole of the 90 years since 1815 there have been only three others—1829, 1843, and 1844—with less than 0·5 inch. The rain on Thursday was very general all over England.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Probably the few notes I am going to write about 1905 should have appeared last week; but, on account of the early date at which it was necessary to post, there was not time to write upon the doings of the expiring year. So far as we in this quarter of the world are concerned, there is nothing to which we can point, and say that the year 1905 will be memorable because of it. Treating the subject geographically, we will begin with Glasgow, as the most important centre of the gas supply of Scotland. Here, after noticing that the new gas-works at Provan have, in their working during the whole year, come altogether up to expectations, there is little else to record except that the Corporation took the first steps towards the fostering of a day consumption of gas, by, in the first place, the reduction of the illuminating power of the gas, as from June 1 last, from over 20 to 18 candles; and, in the second place, by reducing the price of gas consumed for power purposes from 2s. 1d. to 1s. 9d. per 1000 cubic feet. The result of this new policy in the case of so large a gas undertaking cannot fail to be a subject of interest, when time has been given to it to develop.

In Edinburgh and Leith, the Gas Commissioners have had a lively time of it. They had to deal with the complaints of shopkeepers, who considered that the sale of gas cooking, heating, and other appliances by the Commissioners was an interference with their trade. This difficulty was overcome by a species of compromise, which seems to be working well. Then they have been subjected to a harassing series of grumbles, on the part of town councillors not members of the Commission, regarding the illuminating power of the gas, which has had, as its first result, the procuring of the admirable report upon the lighting of the city by Mr. J. F. Simmance, of London, which was given in the "JOURNAL" a fortnight ago, and which has had no further result as yet, for the reason that the councillors have not so far found breath

Start the New Year with

a good resolution—

to put the **"St. Andrew"** Gas-heated Steam Radiator on **Simple Hire.** The business that will result will go a long way towards bringing

A Happy New Year to you.

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with which to discuss it. Smells which are said to come from the Granton Gas-Works when the oxide purifiers are opened have led to experiments being undertaken there which will claim attention when the time comes for their success, or failure, to be announced. The Commissioners had to face a vexatious litigation regarding the pollution of a brewery well in the neighbourhood of their old gas-works in New Street, Edinburgh, and were cast in damages to the amount of £3730. They have reclaimed against this decision; but the case has not yet been reached by the Court of Appeal. The Commissioners have in view a reduction of the illuminating power of the gas, but are unable to proceed until the Town Council make up their minds as to what they are to do in the matter of Mr. Simmance's report.

In Dundee, there was areduction of nearly 15 million cubic feet in the quantity of gas manufactured; but the quantity sold only showed a reduction of $3\frac{3}{4}$ millions. The Town Council were able to reduce the price of gas by 2d. per 1000 cubic feet; and they also resolved to abolish meter-rents in respect to all the smaller sizes of gas-cookers.

The Aberdeen Corporation Gas Department are in the happy position of having no history except that of continued progress; the output of gas having been 20 million cubic feet more than in the year preceding. A reduction in the price of gas by 1d. per 1000 cubic feet to ordinary consumers was effected, with a further reduction to users of gas for motive power.

Being moved thereto by the example of the Corporation of Glasgow, the Corporation of Perth resolved to reduce the illuminating power of the gas from 25 to 20 candles, which is their authorized standard. There was also a large increase in the output of gas; and the price was reduced by 2d. per 1000 cubic feet. In Denny, there was a reduction in the illuminating power of the gas from 25 to 20 candles.

Increased outputs of gas were experienced—in Dunfermline, 3 million cubic feet; in Stirling, $3\frac{1}{2}$ millions; in Edinburgh, $17\frac{1}{2}$ millions; in Peterhead, nearly $2\frac{1}{2}$ millions; in Hawick, 1 million; in Galashiels, nearly $3\frac{1}{2}$ millions; in Arbroath, $4\frac{1}{2}$ millions; and in Selkirk over 4 millions.

Reductions in the price of gas were effected, among other places, at Galashiels, $2\frac{1}{2}$d. per 1000 cubic feet; Kilsyth, $2\frac{1}{2}$d.; St. Andrews, 2d.; and Annan, 2d.

New gas-works were opened at Peebles, and re-constructed gas-works at Renfrew and Campbeltown. New gas-works have been erected at Falkirk, and are at work, but have not yet been formally opened. New Gas Companies have been formed at Kelty and Polmont.

Of new plant, there is to be noted the introduction of De Brouwer charging-machinery in the Alloa Corporation Gas-Works; and of charging and discharging plant by Messrs. R. Dempster and Sons, Limited, of Elland, in the new works at Falkirk.

There have been gas transfers at Monifieth and Grangemouth; and a transfer at Lanark is in progress.

The price of coal went down in the first part of the year; but since then it has risen considerably. It is now a good deal higher than it was at the beginning of 1905; and there is every appearance of its rising still higher.

There have been few changes of note in the *personnel* of the managers of gas-works; the year having been a quiet one in this respect. Of removals by death, there may be noted: Mr. A. Smith, of Aberdeen; Mr. W. Scott, of Blantyre; Mr. T. Stewart, formerly of Larkhall; Mr. W. Chalmers, of Alva; Mr. J. M'Ewan, of Gourock; Mr. J. Black, formerly of Newport (Fife); and Mr. J. Gunton, formerly of Carnoustie.

These exhaust my remarks. They disclose nothing of unusual interest, nor anything which can be described as portentous; but they reflect a sound condition of the industry, and afford material which, when gathered together—and that is almost the only reason that can be given for the infliction of yearly summaries—is calculated to give renewed courage in the prosecution of a great and growing department of the commercial life of the nation.

The Corporation of Musselburgh on Thursday last agreed, on the unanimous recommendation of the Cleaning and Lighting Committee, to accept the offer of the Musselburgh Gas Company to light the streets in the town with incandescent gas-lamps, except where electric arc lamps have already been introduced, and a portion of the road leading to Edinburgh; the latter being reserved in the expectation that the Corporation of Edinburgh may carry their electric lighting scheme down to the boundary of the burgh of Musselburgh. It was intimated that electric lighting would cost somewhere about twice as much as incandescent gas.

Edinburgh is now in the happy position of having an abundant supply of water; but even yet there are some who are not satisfied. It is the quality that is the ground of complaint. At a meeting of the Water Trust last week, a letter from a firm of aërated water manufacturers was read, regarding the quality of the water supplied to them, and stating that they reserved the right to bring an action for damages against the Trust. The Trust instructed the Clerk to reply that the depreciation in the quality of the water, if there were any, was due to the depletion of the reservoirs consequent on the severe drought which had been experienced, and to repudiate liability. At the same meeting of the Trust, minutes were submitted by the Works Committee, in which there was a long report by the Engineer—Mr. W. A. Tait—upon the subject of proposed new piping so as to utilize the Talla water in connection with some of the other works belonging to the Trust. At the present time, there is no service reservoir in connection with the Talla scheme; and in the event of an accident happening at any place on the aqueduct, 36 miles in length, the supply from Talla would have to be stopped until the necessary repairs were made. The quantity of water which can be held in the service reservoir at Alnwick Hill is little more than one day's supply to the district served from there. The Trust resolved to indefinitely postpone consideration of this report; so that the works suggested by Mr. Tait will certainly not be undertaken for a while yet.

CARBURETTED WATER-GAS APPARATUS

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The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cub. Ft. Daily.		Cub. Ft. Daily.		Cub. Ft. Daily
Blackburn	1,250,000	St. Catherines (Remodelled)	250,000	Tonbridge	300,000
Windsor St. Works, Birmingham	2,000,000	Kingston, Pa.	125,000	Stretford	500,000
Saltley Works, Birmingham	2,000,000	Peterborough, Ont.	250,000	Oldbury	300,000
Colchester	300,000	Wilkesbarre, Pa.	750,000	Todmorden	500,000
Birkenhead	2,250,000	St. Catherines (Second Cont.)	250,000	Saltley, Birmingham (Third Contract)	2,000,000
Swindon (New Swindon Gas Co.)	120,000	Buffalo, N.Y.	2,000,000	York (Second Contract)	750,000
Saltley, Birmingham (Second Contract)	2,000,000	Winnipeg, Man.	500,000	Rochester (Second Contract)	500,000
Windsor St., Birmingham (Second Contract)	2,000,000	Colchester (Second Contract)	300,000	Newport (Mon.)	250,000
Halifax	1,000,000	York	750,000	Tokio, Japan	1,000,000
Toronto	250,000	Rochester	500,000	Pernambuco, Brazil	125,000
Ottawa	250,000	Kingston, Ont.	300,000	Malton	150,000
Lindsay (Remodelled)	125,000	Crystal Palace District	2,000,000	Duluth, Minn. (Second Cont.)	300,000
Montreal	500,000	Duluth, Minn.	300,000	Brockville, Ont.	250,000
Toronto (Second Contract, Remodelled)	2,000,000	Caterham	150,000	Smethwick	500,000
Belleville	250,000	Leicester	2,000,000	Gravesend	300,000
Ottawa (Second Contract)	250,000	Enschede, Holland	150,000	Newport (Mon.) (Second Cont.)	250,000
Brantford (Remodelled)	200,000	Buenos Ayres (River Plate Co.)	700,000	Toronto (Third Contract)	750,000
		Burnley	1,500,000	Toronto (Fourth Contract)	1,000,000
		Kingston-on-Thames	1,750,000	Montreal, Ont. (Second Cont.)	1,800,000
		Accrington	500,000	Hamilton, Ont.	400,000

Leeds, 1,800,000 C. Ft. Leicester (Second Contract), 1,000,000 C. Ft. Newcastle-on-Tyne, 1,800,000 C. Ft.

And, in addition, 8,150,000 Cubic Feet daily; also Coal-Gas Plants at Nelson, B.C., Chatham, Berlin, Napanee, Owen Sound, Calgary, and Winnipeg.

CURRENT SALES OF GAS PRODUCTS.

Week ending Dec. 30.

There has been a quiet time in the London market for tar products during the last few days, as was to be expected; but, on the whole, a very fair amount of business has been done. Pitch has again been in good demand, and stocks are now reduced to a low ebb. There is no change in the actual prices of any of the products. Sulphate of ammonia in this market is rather better. The demand is good, and nothing would be accepted over the spring months at under £12 15s. per ton on Beckton terms.

LIVERPOOL, *Dec.* 30.

Sulphate of Ammonia.

Although the business of the week has been somewhat interfered with by holidays, the tone of the market has changed for the better. There has been keener competition for the few parcels offered; and the closing quotations are £12 5s. per ton f.o.b. Hull, £12 7s. 6d. to £12 8s. 9d. per ton f.o.b. Liverpool, and £12 10s. per ton f.o.b. Leith. These prices have also been bid for January delivery, and in some cases accepted. Inquiry for deliver over the spring months seems to have become more serious than it was a week or two ago, and it looks as though "bear" selling in that position had ceased for the present. Business has been done at £12 10s. per ton f.o.b. for January-April delivery; but at the close makers' views are £12 12s. 6d. to £12 15s. per ton, according to port.

Nitrate of Soda.

This article, though quiet, is firm on spot at 10s. 9d. to 11s. per cwt., according to quality

LONDON, *Dec.* 30.

Tar Products.

Business has been very quiet during the past week, as is usual about the end of the year. In carbolic acid, crude is still in fairly good demand, and business has again been done in 60's at 1s. 9½d. for prompt; while this price has been declined for January-June, 1906. The position in crystals remains unchanged; but there is a report that there are further inquiries from both Russia and Japan, which may tend to improve the market for this article. In 90 per cent. benzol, there is practically nothing doing. It is said there are buyers at 10d. for January-March; but makers will not consider less than 10¼d., and in most cases ask 10½d. Toluol continues firm, and there is really nothing offering for early delivery; while London makers quote 1s. for January-March. The London market for creosote is decidedly easier, especially for forward delivery; and there is more offering for January-June shipment. The demand still continues very good both in Yorkshire and the Midlands; and prices are fairly well maintained. In solvent naphtha, there is really nothing offering for early delivery, but makers are certainly more anxious to arrange business for all next year. Some sales of special quality 95 per cent. at 160° are reported to have been made at from 1s. 1½d. to 1s. 2d. for January-March. The market in pitch is very quiet, and sales are certainly reported at very low prices, especially in London, where 32s. 6d. has been accepted for January-March shipment. There is more offering in the Yorkshire district, and small parcels are reported to have been sold at 31s. 6d. to 32s. In the Lancashire district, the market continues fairly steady, and there does not appear to be much offering for early delivery. As regards the Continent, buyers seem to be well supplied for the time being; while in South Wales consumers will only consider business for January-June at prices considerably under those ruling for prompt shipment.

The average values during the week were: Tar, 18s. to 22s.; Pitch, London, 32s. 6d. to 32s. 9d.; east coast, 31s. 6d. to 32s.; west coast, 30s. 6d. to 31s. 6d. Benzol, 90 per cent., 10d.; 50-90 per cent. 10½d. to 10¼d. Toluol, 11¼d. to 11½d. Crude naphtha, 4d.; solvent naphtha, 11⅛d. to 1s. 1d.; heavy naphtha, 11⅜d. to 1s. Creosote, London, 1⅜d. to 1⅝d.; North, 1⅛d. to 1⅝d. Heavy oils, 2¼d. Carbolic acid, 60 per cent., 1s. 9½d. to 1s. 9⅝d. Refined naphthalene, £4 10s. to £8; salts, 21s. to 22s. 6d. Anthracene, "A" quality, 1⅛d. to 1⅝d.; "B" quality, unsaleable.

Sulphate of Ammonia.

The market closes with a slightly firmer tone, especially for prompt delivery. Beckton still quote £12 15s. for January-March; while the South Metropolitan Company now ask £12 16s. 3d. on their own terms. In Hull, business is reported at £12 10s. for prompt, and in fact in one instance £12 11s. 3d., and even £12 12s. 6d., is stated to have been paid for January-March shipment. In Leith, makers are firmer in their ideas, and there are now no sellers at under £12 11s. 3d., though evidently some quantity was placed at £12 10s.

Assessments in Shoreditch.—The result of the quinquennial valuation which has just been concluded in Shoreditch is to reduce the assessments of railway, tramway, and gas companies by £11,000. The reductions in the railways and tramways is stated to be due to the competition of the new electric railways; while the decreased assessment of the Gas Company, it is reported, was chiefly due to "the success of the municipal electricity undertaking, the assessment of which has been substantially increased."

Water-Works Extensions at Brighton.—In connection with the Brighton water supply, a new pumping-station (costing £88,000) has been erected at Falmer; and it was opened last month by the Mayor (Alderman J. Colbourne, J.P.) and the Mayoress. In proposing a vote of thanks to the Mayoress, Alderman Reeves (the oldest member of the Water Committee) gave some interesting particulars of the past history of the undertaking; and he said they were now pumping 7 million gallons a day, besides which money was pouring into the coffers of the Finance Committee in relief of the rates.

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COAL TRADE REPORTS.

Lancashire Coal Trade.

The Christmas and New Year Holidays left the coal trade of the country for the past week in a state of "suspended animation." Stocks were got in beforehand by discriminating people. Prices remain unaltered. That there has been a considerable improvement in the coal trade generally during the last few weeks is admitted; and the operative miners, as we anticipated, are about to apply for an increase of 5 per cent. in wages. The coal owners, on the other hand, are seeking a reduction of 5 per cent., and both applications will be considered about the end of the present month. A long-standing price-list dispute between the employés and employers at the Hafod colliery, near Ruabon, has been settled by arbitration. The new year begins with the following quotations at the pits' mouth:—Best house coal 13s. 6d. to 14s. 6d., secondary 12s. to 13s., common 9s. to 10s., steam and forge 8s. to 9s., best engine fuel 7s. 6d. to 8s. 6d., best slack 6s. 6d. to 7s. 6d., medium 6s., washed slack 7s. to 7s. 6d., common 5s. to 5s. 9d. Coal for shipping is 9s. 6d. to 10s. 6d.

Northern Coal Trade.

There has been some irregularity in the coal trade of late; the holidays having lessened the production, and allowed also a fleet of steamers to arrive for coal cargoes. In steam coal, the demand is now fairly good; and in a day or two, it is probable that, with a normal output, the production will be better taken up, and the prices will be more regular. At the present time, there is a relatively high value for any cargoes for early delivery; and it may be said that the basis of price varies from 9s. 3d. to 9s. 6d. per ton f.o.b., according to the time of loading. Other kinds of steam coal are relatively as firm. In the gas coal trade, there is a strong demand, holiday pressure having reduced the stock of coal, through the deliveries of fuel being less; and this will be the case for some days. Durham gas coal varies in price from 8s. 6d. to 9s. 6d. per ton f.o.b. for occasional cargoes, according to quality. The large contracts for the Copenhagen gas supply are now before the trade; but it will be about a fortnight before they are decided, though some advance in the prices seems to be expected, as the market here is decidedly stronger for gas coals than it was when the last contracts were settled. In some quarters, there is a disposition to believe that a higher range of values for good gas coals is now being entered on. Coke is firm; and gas coke shows the irregularity noted for the last few weeks—the production being at its fullest, and the demand not correspondingly increased. Prices are unchanged for good gas coke.

Scotch Coal Trade.

There is great activity in both the home and export branches of the market. So great has been the drain in recent weeks that it is reported that all accumulations have been almost used up in supplying orders. This is a situation which would seem to point to higher prices ruling in the early part of 1906, more particularly as forward selling has not been encouraged very much of late. The prices quoted are: Main 7s. 6d. to 7s. 9d. per ton f.o.b. Glasgow, ell 8s. 6d. to 9s. 3d., and splint 9s. 9d. to 10s. The shipments for the week amounted to 279,376 tons—an increase of 19,411 tons upon the preceding week, and of 52,840 tons upon the same week of last year. For the year to 27th ult., the total shipments amounted to 12,242,984 tons—an increase of 704,899 tons upon the corresponding period.

Gas-Mantle Amalgamation in Germany.

According to the "Ironmonger," five well-known manufacturers of incandescent burners in Berlin have amalgamated their businesses, as from yesterday, and formed a limited Company, with a share capital of 1,100,000 marks (£55,000), under the style of the Neue Gasglühlicht Aktiengesellschaft (New Incandescent Gas-Light Company, Limited). The members of the combination are the firms of Dr. Willy Saulmann, Dr. Alfred Oppenheim and Co., Julius Norden and Co., Julius Janz, and Gustav Janz. Mr. Julius Norden, whose firm is the only one among the amalgamated concerns which has a house of its own in England, will act as representative of the Company in London. In Germany, Dr. Fritz Saulmann and Mr. Salomon will have the commercial management; while the technical direction will be in the hands of Dr. Alfred Oppenheim and Mr. Julius Janz. It is understood to be the intention of the new Company to continue to sell their products (for the present, at any rate) under the names of the old firms. Our contemporary thinks the combination has been formed chiefly for the purpose of offering more effective opposition to the German Incandescent Gas-Light Company, who have recently absorbed several smaller companies, and who have been gradually acquiring predominant influence in the market; but it is considered by no means unlikely that the new company may come to a price arrangement with their chief rival.

Asphyxiated by Gas.—Mr. H. G. Killick Jenner, a music conductor, of Hastings, was last Friday found asphyxiated through an escape of gas in his office at Bexhill.

The Escape of Chemical Refuse from the Coventry Gas-Works.—The Town Clerk of Coventry has submitted to the Gas Committee of the Corporation summonses issued against them, at the instance of various persons, in respect of damage consequent on the alleged pollution of the River Sowe, caused by the escape of chemical refuse from the new gas-works at Foleshill on the 29th of May last. The Committee have resolved that, in order to save expense to the Contractor, through whose neglect the damage was caused, the Town Clerk should be instructed to hand the summonses to the Contractor's Solicitor, with authority to him to conduct the defence, on condition that he and his client give a satisfactory indemnity in respect of moneys which may be recovered in the action and costs.

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STATION GOVERNORS.

Improvement of the Paris Water Supply.

In the "JOURNAL" for the 5th ult. (p. 697), we gave some particulars in regard to certain projected improvements in the water supply of Paris. It appears from an account given in the "Annales des Ponts et Chaussées," and quoted thence in the Engineering Supplement to "The Times," that they will augment others which have lately been completed for bringing to Paris the waters of the Rivers Loing and Lunain to augment the existing supply of drinking water derived from the Dhuis and the Vanne. This is the fourth operation of this nature undertaken since the year 1860, and forms part of a vast project to raise the daily volume of drinking water by a total of some 52 million gallons, in accordance with the scheme drawn up by M. Couche in 1884. The new aqueduct has been designed for a total daily flow of about 40 million gallons; but it will not, with the volume at present available, convey more than from 9 to 11 million gallons of water daily from the valley of the Loing and its tributary, the Lunain. The actual joint capacity of all the pure-water supplies for Paris amounts, with the completion of this extension, to nearly 108 million gallons.

Meter-Rents at Malton.—The Malton Guardians have evidently an eye to economy, for one of their number, at a recent meeting, complained of what he called the unfairness of the Malton Gas Company in charging meter-rents at the Workhouse. He said he deemed this most unjust, as all other tradesmen had to find the measures, utensils, &c., employed in their trade. He understood that by law no gas company could pay more than 10 per cent. per annum. The Malton Gas Company had paid 12½ per cent.; and he thought the Guardians could recover from them 2½ per cent. for three years back. They had got the Board of Trade to allow them to pay 12 per cent. on condition that they reduced the price of gas; and having done this, they put on meter-rents. He suggested that the matter be taken into consideration before the next contracts are entered into. To this the Board agreed

Opposition to the Portsmouth Water Bill.—The proposal of the Portsmouth Water Company to extend their area for obtaining water beyond Havant and Bedhampton into West Sussex continues to excite opposition. The Westbourne Parish Council recently had the matter under consideration, and it was resolved to insist upon the following demands for West Sussex: "That the Company shall be compelled to supply water gratis when the wells of the district are drained dry; that the Company shall not be allowed to open the roads without permission from the road authority, and be required to afterwards repair them satisfactorily; that the charges for water, whether by rate or by meter, be much lower than at Havant or Emsworth; that a standard price be fixed, and that when the Company shall pay more than 4 per cent. there shall be a reduction; that every householder shall be allowed to claim to be supplied with water by meter; and that the powers under the Act shall cease unless they are exercised within three years." A copy of this resolution is to be sent to all the governing bodies within the district.

Lincoln Water Supply.—The Water Committee of the Lincoln City Council have decided to recommend a renewal, for an indefinite period, of the contract with the Great Northern Railway Company for a daily supply of water from the Company's springs at Willoughby. The new bore at the Boultham Water-Works has now been sunk to a depth of 1350 feet. It was anticipated that the red sandstone would have been reached at a depth of 1450 feet; but 100 feet more of lias has been found than was anticipated.

Christmas Shopping in the Dark.—Telegraphing on the 22nd ult., the New York correspondent of the "Daily Telegraph" said: "At Indianapolis last night, when Christmas purchasers crowded the shops and bazaars, the electric lighting of the district suddenly failed. Extraordinary scenes followed, and accidents upon staircases and in lifts were narrowly avoided. In most instances cool heads averted the panic which threatened to occur at some of the biggest bazaars, where the public were packed like sardines. The merchants in some cases called out that everyone on going out would be searched, thinking thereby to terrorize thieves. It was not until oil-lamps and gas had been secured that order was restored."

Shipley Water Supply.—In view of the increasing demands on the water supply and of recent dry summers, a connection was made more than a year ago between the Shipley water-mains and those belonging to Bradford which pass through the town. This was done to provide an additional supply in case of necessity. Notwithstanding the dryness of the past summer, however, and the added population of the district, no necessity has yet arisen for the transference of any water from the Bradford mains. Meanwhile, arrangements have been made which are likely to prevent any shortage of water in Shipley for a long time to come; a scheme having been completed for obtaining water from the springs on Rombalds Moor and conveying it to the Baildon Bank service reservoirs. From the source a volume of 500,000 gallons of water a day is being obtained.

A Big Water-Power Electrical Project.—A project is just now on foot in Copenhagen for the transmission of electrical power from Sweden to Denmark. In the town of Lund it is proposed, says "Commercial Intelligence," to utilize some of the large waterfalls on the Laga river, not only for lighting Lund itself, but also several other towns in the South of Sweden. During the negotiations made with the owners of these falls, it was stated that a Syndicate in Denmark were also making offers for the falls with a view to using them as a source of electric energy. The Laga river comes from the Smaaländ uplands, runs for 3 miles through the province of Halland, and has two large falls—namely, the "Majefos" and "Katefos" of 25 feet and 35 feet respectively. This latter is about a mile from the river's mouth, which is at a place called Laholm. Here the Danish Syndicate propose to erect power stations; the electricity being transmitted by cable to the coast of Helsingborg, and thence, by means of a submarine cable, to Denmark, *viâ* the Oeresund.

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Sales of Shares.—Recently Mr. J. P. Stafford sold 25 £10 fully-paid shares in the Altrincham Gas Company at an average price of £15s. 5s. each; and 10 £5 original shares (fully-paid) in the Stretford Gas Company at an average of £12 1s. 6d. At an auction sale lately, Mr. S. W. Jewell disposed of 20 £5 (£4 12s. paid) and 36 £1 (fully paid) shares in the Bodmin Gas Consumers' Company, Limited. The former realized from £9 5s. to £10 2s. 6d. each; and the latter, from £1 18s. to £2 each.

Reduction in the Price of Gas for Power at Eastbourne.—The Directors of the Eastbourne Gas Company announce their intention of allowing a discount of 10 per cent. on the ordinary price (2s. 8d. per 1000 cubic feet) for all gas used for power purposes, subject to the accounts being paid monthly, when a further 1¼ per cent. will be granted. This discount is in addition to the 5 per cent. already allowed on accounts of £100 per annum, and 2½ per cent. on those amounting to £40 in a year.

Penzance Water Supply.—An inquiry was recently held at Penzance by Colonel A. G. Durnford, one of the Local Government Board Inspectors, respecting an application by the Town Council for power to borrow £4500 for water supply purposes. It was explained by the Town Clerk (Mr. T. H. Cornish) that water was brought from the reservoirs to the town by two mains, one of which supplied the higher district and the other the central and lower parts of the town. These pipes were now corroded, and did not allow of the fullest supply; while the demand had increased. It was proposed to lay an additional 12-inch pipe from the reservoir to the town. Mr. F. Latham, the Surveyor, said the new main would allow of an ample supply of water to all parts of the town.

Barnstaple Electricity Undertaking and the Public.—An inquiry was lately held at Barnstaple by Colonel Durnford, an Inspector of the Local Government Board, respecting an application for power to borrow £4000 for electric lighting purposes. It was stated that the capital expenditure was £29,783. The number of customers had increased from 98 three years ago to 256. The revenue for the year was £3085, and the expenditure £3110. That no surplus was shown, was due to the fact that the accounts for the Christmas quarter were not included. Mr. C. E. R. Chanter, the Chairman of the Barnstaple Water Company, and Vice-Chairman of the Barnstaple Gas Company, opposed the application. He explained that he was a large ratepayer, and said that, while no doubt there was a big revenue on the electric lighting, it had come out of the pockets of the unfortunate ratepayers. To make the concern pay, the charge for public lighting was materially increased. Gas lighting in 1900 cost £691, in 1901 £713, and in 1902 £759; while in 1903 gas and electric lighting cost £1312, and in 1904 £2043. The Town Clerk suggested that Mr. Chanter came as representing the Gas Company, and complained that the Company were suffering. The Inspector remarked that Mr. Chanter had not said this. The Town Clerk added that no abnormal amount was charged for electric lighting. If the public had more light, they must pay for it. Formerly the streets were lighted with rushlights, and one could not see from one lamp to another. Mr. Chanter said he should be prepared to face a public meeting on the point. The Town Clerk reiterated that it was mere trade opposition, and saidthat the success attending the electric light had brought about a reduction in the price of gas from 3s. 9d. to 3s. 6d. per 1000 cubic feet.

The Woodhall Spa Urban District Council have decided to adjourn for six months the question of the establishment of gas-works, as it is now too late to apply for parliamentary powers next session.

By the charity of the employees of Messrs. Thomas Glover and Co., Limited, who subscribed £21, to which the firm added another £10, 700 children of the Edmonton unemployed were last week given a substantial meal.

The Withnell Urban District Council, who are building an entirely new gas-works, have instructed the Richmond Gas Stove and Meter Company, Limited, to fit up houses with complete installations—including meter, pipes, fittings, griller, and (in some cases) cooker. It is expected that about 500 houses will be completed early this year.

Messrs. George Glover and Co., Limited, have arranged with Mr. Charles Laughton to be their representative in an important district in the Midlands and North of England, as from the beginning of the present year. Mr. Laughton is already well known in the district, as he has represented Messrs. John Wright and Co. for twenty years.

The Standard Gas-Engine Company, Limited, has been registered with a capital of £10,000, in £1 shares, to acquire and take over as a going concern the business of general engineers, internal combustion engine makers, &c., carried on by Messrs. O. Sumner and J. L. Leyland, at Preston, as the Standard Oil-Engine Company, and to adopt an agreement with the vendors.

We have received from Messrs. George Glover and Co., Limited, a combined blotter and calendar for the current year. The strips of blotting-paper are covered by a movable enamelled card, having upon the right-hand side the calendar arranged in months, and on the left a view of the two 3000-light dry meters lately made by the firm for use with gas-engines, and noticed in the "JOURNAL" for Nov. 7.

Messrs. Joseph Taylor and Co. have in hand a saturator of their latest type for the Rossendale Union Gas Company; a saturator, heater, pipes, catch-box, &c., for the Limerick Corporation Gas Department; a repeat order for a large saturator, weighing about 12 tons, for either fishing or steam discharging, to the order of a well-known firm of gas-plant makers; and some work (including a saturator) for exportation abroad.

Messrs. F. C. Sugden and Co., of Leeds, have sent us one of their pocket-books for the current year. It is specially suitable for gas engineers and managers, as each opening in the diary contains a blank table for entering the working results for the week, and for the corresponding week of last year. The diary is preceded by some particulars of the firm's generator and regenerator settings, &c., and followed by some useful tables. Accompanying the book, which can be easily carried in the pocket, is the now general insurance coupon.

The Port Elizabeth Municipal Electric Lighting Committee recently issued a pamphlet in which comparisons were made as to the cost of gas and electricity as illuminants. As the figures given were found by Mr. William Arnott, the Manager of the South African Lighting Association, to be in most cases wrong, he issued another—a very neat and artistically printed booklet—showing the capabilities of gas. He starts with the bold declaration that gas has never yet been beaten by electricity in the matter of cost, and goes on to show that at present it is far ahead of every other system of lighting. He also offers a few useful remarks on the value of gas as a culinary and heating agent—a matter which is more fully dealt with in a separate leaflet.

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MEADE-KING, ROBINSON, & CO.,
Importers and Distributors of GAS OILS, Representing the Strongest Independent Refineries in America, 8, EXCHANGE STREET, MANCHESTER, and 11, OLD HALL STREET, LIVERPOOL.

GAZINE—A radical Solvent and Pre-
ventative of Naphthalene deposits, which has been used for many years on the Continent for the cleaning of Mains and Services, and is now being adopted in England. It is also used for the Enrichment of Gas, and has an Illuminating Value of double that of 90 per cent. Benzol.
Supplied by C. BOURNE, 120, Manor House Road, NEWCASTLE-ON-TYNE.

YOUNG Man requires Engagement as
WORKING MANAGER, or position of Trust, Good Carbonizer, and well up in the routine of small Works, including Gas Fitting, &c.
Address No. 4530, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GENTLEMAN (Young), at present in
one of the largest Stourbridge Fire-Brick Manufacturers' Office, desires change for position as Traveller and filling remainder of time in Office. Highest References.
Address No. 4525, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a position as Show-Room
ATTENDANT with Provincial Gas Company. Smart Salesman, good address, thorough knowledge of Stoves, Fittings, Burners, and Gas Office Duties. Excellent Testimonials.
Address No. 4528, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

YOUNG Man (Age 26), at present em-
ployed, wishes to better himself. Well up in the routine of a Gas and Water Company; Mechanic; can take any Position on Works; Distribution; or in Office, Works, or Distributing Department preferred. Excellent Testimonials.
Address No. 4529, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a reliable man with
practical knowledge of Gas-Fitting, to TAKE CHARGE of Show-Room and fit up houses at small town within 40 miles of London.
Apply, by letter, with References, to No. 4527, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS Testing.—The Advertiser, who
desires an Independent Test of Gas, would be glad to communicate with a Firm of repute undertaking this work and providing their own Instruments.
Apply to No. 4526, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

DENBIGH GAS AND WATER COMPANIES.
WANTED, a Foreman for the above
Works. Must be a reliable Man, able to do Gas-Fitting, Plumbing, and understand the General Routine of the Works, including Testing for Water Leakages.
Wages, 30s. per week, with House, Coal, and Gas free. Abstainer preferred.
Applications, stating Age and previous Experience, with *Copies* of Three recent Testimonials (which will not be returned), to be sent to the undersigned on or before Friday, the 5th day of January, 1906.
W. EWART BROCK,
Manager and Secretary.
Gas-Works, Denbigh,
Dec. 28, 1905.

WANTED to Purchase, Gas Carbon
delivered at nearest Station to Gas-Works, in quantities of not less than Four Tons.
State Price to No. 4512, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

STATION Meter (Second-Hand) Wanted.
Capacity, about 40,000 cubic feet per hour. Must be Modern (Faced-Joints preferred) and in Perfect Condition.
State all Particulars to No. 4524, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SPENT Oxide for Sale (about 30 Tons).
Apply for Particulars to DAVID VASS, Engineer and Manager, Gas-Works, AIRDRIE.

FOR SALE—About 550 ft. of 3-inch
Galvanized Wrought-Iron Tube, in new condition What Offers?
Apply to P. HODGKINSON, Devonshire Terrace, BEXHILL.

GAS PLANT for Sale—I can always offer
NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

M. LEVY ON INCANDESCENT GAS LIGHTING.
THE attention of Engineers, Con-
tractors, Manufacturers, and others interested in the use of Gas for Lighting, Heating, and Motive Power, is called to the work on "INCANDESCENT GAS LIGHTING," by M. PAUL LEVY, C.E., of Paris, which was noticed in the "JOURNAL" on the 21st of November. It is a large volume of 284 pages, with 127 figures and 8 large plates.
Copies may be obtained at the Office of the "JOURNAL," at the Price of 8s. 6d. each, post free.

FOR SALE.
GASHOLDER, about 20,000 cubic feet
capacity. In perfect Working Order, complete with 6-inch Valves and Connections; also 6 Columns with Latticed Girders. Can be seen at work.
Tenders to be sent to R. SEYMOUR TOBEY, Engineer, Horley District Gas Company, Horley, SURREY.

TO CEMENT MANUFACTURERS, BRICK MAKERS, AND OTHERS.
THE Swansea Gaslight Company are
prepared to receive TENDERS for the purchase of their surplus COKE, for delivery over the next Twelve Months, f.o.b. South Dock, Swansea, or f.o.r.
There is connection with the G.W. Rly., L. & N.W. Rly., Midland Rly., and R. & S.B. Rly.
Also they offer 2000 to 3000 Tons of BREEZE.
THORNTON ANDREWS,
Engineer.
Dec. 27, 1905.

COUNTY BOROUGH OF ROCHDALE.
TO FIRE BRICK MAKERS AND OTHERS.
THE Gas Committee of the above Cor-
poration invite TENDERS for the supply of such quantities of FIRE BRICKS, BLOCKS, TILES, &c., as they may require during a period of Twelve Months ending the 31st of December, 1906.
Forms of Tender may be obtained on application to Mr. T. Banbury Ball, the Manager at the Gas-Works.
Tenders, endorsed "Fire-Clay Goods," must be sent in to me not later than noon on Wednesday, Jan. 10 1906.
By order,
WM. HENRY HICKSON,
Town Clerk.
Town Hall, Rochdale,
Dec. 30, 1905.

ACCRINGTON DISTRICT GAS AND WATER BOARD.
RETORTS AND FIRE-BRICKS.
THIS Board are prepared to receive
TENDERS for the supply and delivery of RETORTS and FIRE-BRICKS required during the Year 1906.
The probable requirements are 92 Retorts and 15,000 Bricks for Accrington, and 32 Retorts for Great Harwood.
Tenders, addressed to the Chairman of the Board and endorsed "Tender for Fire-Clay Goods," to be in my hands on or before Wednesday, the 10th of January.
CHARLES HARRISON,
General Manager.
Genera Offices,
St. James' Street,
Accrington, Dec. 15, 1905.

TENDERS FOR GAS COAL.

THE Lighting Department of Copenhagen is prepared to receive TENDERS for the supply and delivery of 175,000 Tons of GAS COAL from the beginning of March until the end of December, 1906.

The Lighting Department reserves the right to divide the Contracts between two or more Contractors.

Further Information and Conditions for the delivery may be obtained on application to Direktoeren for Kóbenhavns Belysningsvæsen, Vester Bou levard, 22, Copenhagen, B.

The Tenders, sealed and marked "Tilbud paa Kul," to be sent to Direktoeren for Kóbenhavns, Belysningsvæsen, Vester Boulevard, 22, Copenhagen, B., before the 15th of January, 1906, Twelve o'clock, at which time the Tenders will be opened in the presence of the parties tendering who are in attendance.

THE LIGHTING DEPARTMENT OF COPENHAGEN.
Dec. 14, 1905.

PLYMOUTH CORPORATION WATER-WORKS.

TENDERS are invited for the supply of the following GOODS and MATERIALS for a period of One Year—

Fire Hydrants,
Lead Pipe and Pig Lead,
Stopcocks, Ferrules, &c.,
Cast-Iron Work,
Sluice Valves.

Particulars and Forms of Tender can be obtained at this Office on and after Monday, the 1st of January, 1906.

The lowest or any Tender will not necessarily be accepted.

Tenders, enclosed in envelopes provided, to be delivered at this Office by Twelve o'clock noon on Tuesday, the 16th of January, 1906.

FRANK HOWARTH, Assoc.M.Inst.C.E.,
Water Engineer.

Municipal Buildings, Plymouth,
Dec. 28, 1905.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at MR. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

NEW ISSUE OF 2500 £10 ORDINARY SHARES

Ranking for a Standard Dividend of 7 per cent., subject to the Sliding-Scale, the Dividends on similar Shares in the Company having, since 1884, been regularly paid at the rate of 7½ per cent. per annum.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Jan. 16, at Two o'clock precisely, in Lots.

Particulars may be obtained at the HEAD OFFICES OF THE COMPANY, in D'Olier Street, DUBLIN, and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
LEA BRIDGE DISTRICT GAS COMPANY
(Supplying Walthamstow and part of Leyton).

NEW ISSUE OF £8000 CONSOLIDATED ORDINARY STOCK,
AND
£2976 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Jan. 16, 1906, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

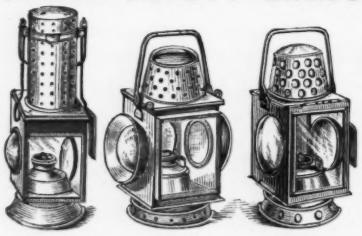
By order of the Directors of the
BISHOPS STORTFORD AND DISTRICT GAS COMPANY.

NEW ISSUE OF £4000 FIVE PER CENT. PREFERENCE STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, Tokenhouse Yard, E.C., on Tuesday, Jan. 16, 1906, at Two o'clock precisely, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

ARMSTRONG'S PATENT
CANDLE SAFETY LAMPS.



No. 1. No. 2. No. 3.

43, MANCHESTER STREET, GRAY'S INN ROAD, W.C.

Now Ready, Price 15s., Limp Cloth,

TWENTY-FIFTH YEAR.

AN
ANALYSIS OF THE ACCOUNTS
OF THE
METROPOLITAN WATER COMPANIES

(Chelsea, East London, Grand Junction, Kent, Lambeth, New River, Southwark and Vauxhall, and West Middlesex),

AND OF THE

ACCOUNTS OF SOME OF THE PRINCIPAL
PROVINCIAL WATER UNDERTAKINGS
FOR THE YEAR 1904-1905.

Compiled by
WOOD, DREW, & CO.,
Chartered Accountants.

LONDON:
WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

ALEXANDER CAMERON,
GAS AND CANNEL COAL MERCHANT,
48, WEST REGENT STREET,
GLASGOW.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER.

Best Gas Coal and Cannel, giving High Illuminating Power, Large Yield per ton, and reasonable in Price.

Telegrams: "DARWINIAN, MANCHESTER."
Telephone 1806.

GILBERT LITTLE & CO'Y LTD.

Conveyor and Elevator Specialists,
Smethwick, Birmingham.

Make known your wants for Conveyors and Elevators to GILBERT LITTLE, the Pioneer Specialist; he will supply them.

THE
"ROTARY"
STATION METER.

Efficiency
Demonstrated.

APPLY—

T. G. MARSH,
MAWSON CHAMBERS, DEANSGATE,
MANCHESTER.

THOMAS TURTON
AND SONS, LIMITED
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY,

LONDON OFFICE:
90, CANNON STREET, E.C.

THE
"BOYS"
CALORIMETER
for determining the calorific value of gases
IS MADE BY
JOHN J. GRIFFIN & SONS,
— LIMITED, —
Makers of Scientific Apparatus,
KINGSWAY, LONDON, W.C.

HEATHCOTE GAS COAL.

Rich in Illuminating Power and yield of Gas.
Above the Average in Weight and Quality of Coke.
Maintains a High Standard in Residuals.

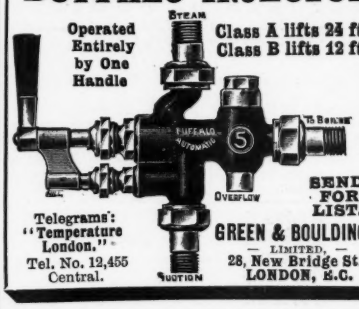
THE GRASSMOOR CO., LD.,
CHESTERFIELD.

JOHN HALL & CO. OF STOURBRIDGE,
LIMITED,
STOURBRIDGE,
Manufacturers of
FIRE-BRICKS, LUMPS, TILES,
GAS RETORTS,
And every description of Fire-Clay Goods.

RETORTS CAREFULLY PACKED FOR SHIPMENT.

'BUFFALO' INJECTOR

Operated Entirely by One Handle



Class A lifts 24 ft.
Class B lifts 12 ft.

SEND FOR LIST.

Telegrams: "Temperature London."
Tel. No. 12,455 Central.

GREEN & BOULDING,
— LIMITED, —
28, New Bridge St.,
LONDON, E.C.

JAMES OAKES & CO.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road,
CITY ROAD, LONDON, N.

Manufacture and keep in Stock at their Works (also large Stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts, and Covers, and rendering Leakage impossible.

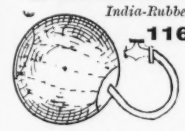
TROTTER, HAINES, & CORBETT,
BRETTELL'S ESTATE LIMITED,
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.
LONDON OFFICE: H. CRESSWELL & Co., LEADENHALL CHAMBERS, 4, ST. MARY AXE, E.C.

MIRFIELD GAS COAL
UNEQUALLED.
Sperm Value 878·85 lbs. per Ton.
Please apply for Prices, Analyses, and Reports, to the
MIRFIELD (GAS COAL) COLLIERIES
RAVENSTHORPE, NEAR DEWSBURY.
LONDON: 22, Park Village East, N.W.

NEWBATTLE CANNEL.
High est Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

THOMAS BUGDEN,
India-Rubber, Guttapercha, Air-proof, and Waterproof Manufacturer,
116 & 118, Goswell Road, LONDON.

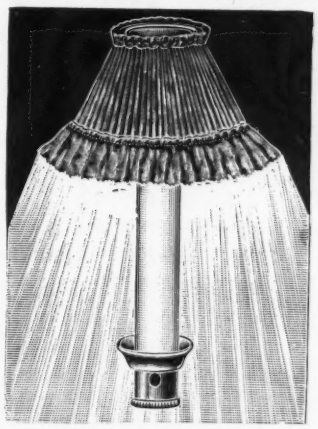

Gas Bags for repairing Mains Round Shape. All Seams Stitched and Taped.

Gas Bags for repairing Mains Cylinder Shape. All Seams Stitched and Taped.

Oilskin Clothing, Diving and Wading Dresses, Sewer Boots, Tar Hose, Stokers' Mitts, Bellows, &c.
Sewer and Fireman's Boots and Stockings

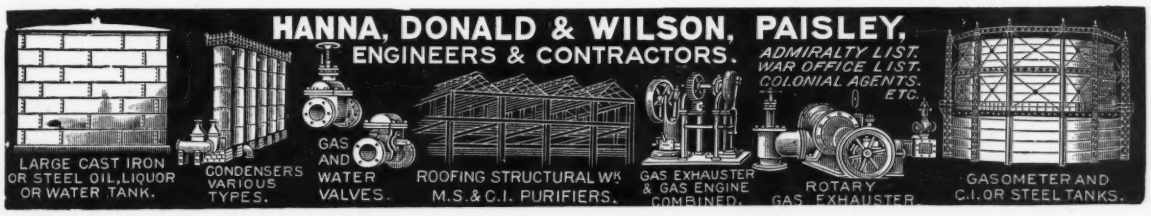
Contractors' and Miners' Woollen Jackets, Trousers Hats, &c.

ORIGINAL MAKER OF
GAS BAGS FOR MAINS.


Patent applied for. Registered.

GREAT NOVELTY
THE
'ROYAL' INCANDESCENT GAS-LIGHT CANDLE.
The most decorative Gas-Light ever offered.
A perfect combustion Burner.
Cannot get out of order.
60-Candle Power with 2½ cubic feet of Gas.
Can be used anywhere instead of a "C" Burner.
Address of your nearest Wholesale Factor will be sent on application to No. 4374, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

HARRIS & PEARSON,
STOURBRIDGE, ENGLAND,
MANUFACTURERS OF
FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.
GLAZED BRICKS AND PORCELAIN BATHS.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ENGINEERS & CONTRACTORS.
ADMIRALTY LIST.
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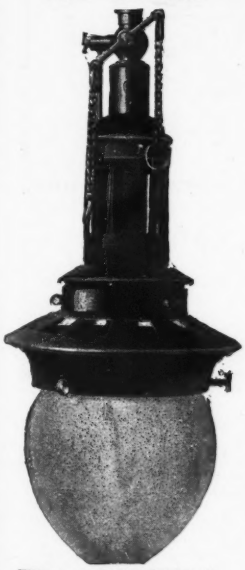
ETC.
LARGE CAST IRON OR STEEL OIL, LIQUOR OR WATER TANK.
CONDENSERS VARIOUS TYPES.
GAS AND WATER VALVES.
ROOFING STRUCTURAL WK M.S. & C.I. PURIFIERS.
GAS EXHAUSTER & GAS ENGINE COMBINED.
ROTARY GAS EXHAUSTER.
GASOMETER AND C.I. OR STEEL TANKS.

THE LATEST.


The "CORONA."
Price complete, 6s.

G.I.C. PROOF POSITIVE. G.I.C.

A few G.I.C. Specialties with Prices.

G.I.C. Maintenance Mantles, for "C" and Kern Burners, **24/-** per gross.

G.I.C. Inverted Mantles, extra double Woven, **42/-** per gross.

G.I.C. Lucas Lamp, High Power and Mantles, for every known Burner, best and cheapest.

G.I.C. Inverted Burners, from **12/6** per doz.

G.I.C. Heavy Steatite Burners, **5/-** per dozen.

G.I.C. Heavy Steatite Bye-Pass Burner, **12/-** per dozen.

G.I.C. Bulbs, Globes, Chimneys, Protection Glasses, and everything for Maintenance at lowest Manufacturers' Prices.

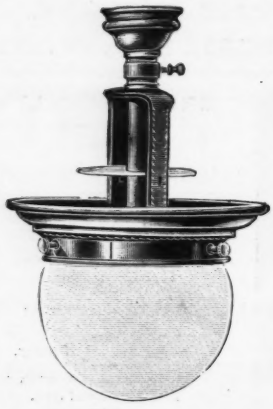
New Lists of Novelties in Lamps, &c., sent on Application.

THE GENERAL INCANDESCENT CO., LD.,
52, Great Eastern Street, LONDON, E.C.,
And at BERLIN, MANCHESTER, DERBY, and NOTTINGHAM.

THE **"JEPCO"** (Patented & Registered)

INVERTED GAS BURNER is the most up-to-date **LIGHT**

ON THE MARKET.



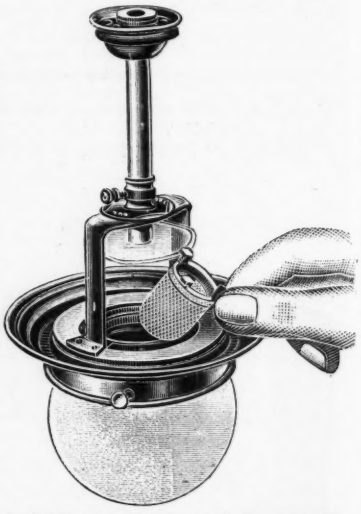
Retail **5**s. **3**d. Complete.

ADVANTAGES:

- Does not light back.
- Has a Mica Smoke Deflector, consuming all smoke caused.
- Consumes only 2½ cubic feet per hour.
- Is absolutely shadowless.
- The only Burner made approaching Electrical appearance.

The nearest possible approach to Electricity.

IS THE SMARTEST SELLING LIGHT THIS SEASON.



Showing operation of fixing Mantle.

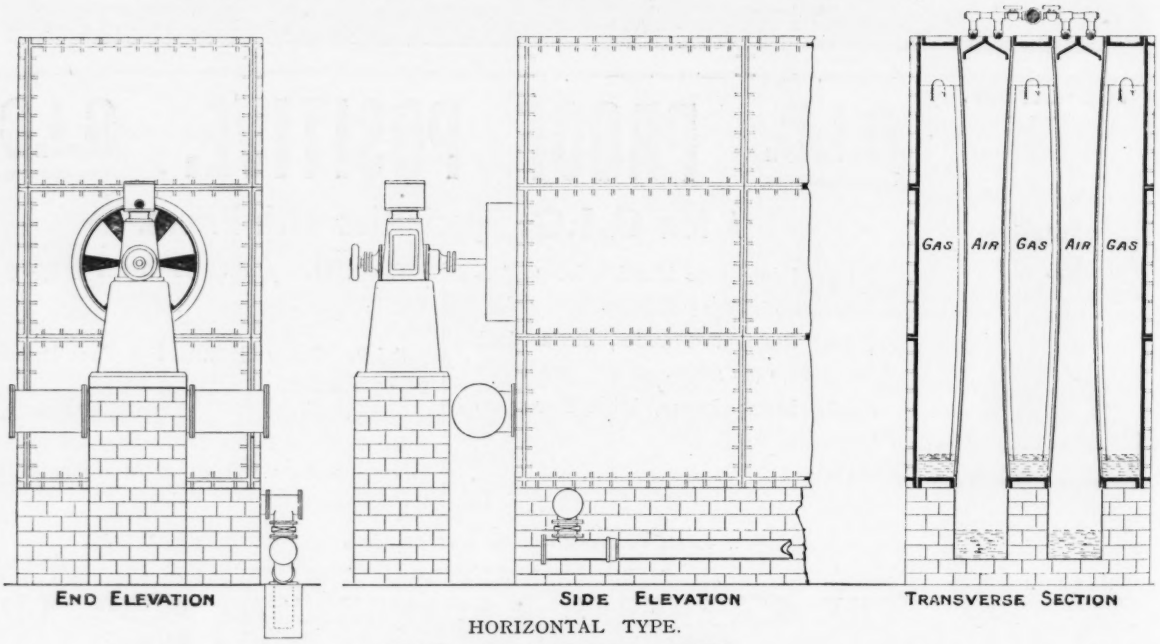
Wholesale only **"PIFCO," LTD., THOMAS STREET, MANCHESTER.**

Application for Trade Terms should be accompanied with Trade References.

BROWNE & CHANDLER'S PATENT

Vaporizing Condensers.

In these Air Condensers a greatly increased efficiency is secured by Internal Evaporation of a comparatively trifling quantity of water, with or without Fan draught.



END ELEVATION SIDE ELEVATION TRANSVERSE SECTION

HORIZONTAL TYPE.

SOLE MANUFACTURERS—

MESSRS. W. J. JENKINS & CO., LTD., RETFORD.

ALBION IRON WORKS,
MILES PLATTING,

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TELEGRAMS—
"STOKER,
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WEST'S GAS IMPROVEMENT CO., LD.

Gas and General Engineers.

CONTRACTORS FOR
COMPLETE RETORT-HOUSE PLANT

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THE HORIZONTAL OR INCLINED SYSTEMS.

WEST'S STOKING MACHINERY—

COMPRESSED AIR OR ELECTRICALLY DRIVEN AND MANUAL SYSTEMS.

Example of a

RETORT-HOUSE

illustrating the application of

West's Regenerator Settings and Retort-Bench Fittings.

West's Coal and Hot Coke Plants.

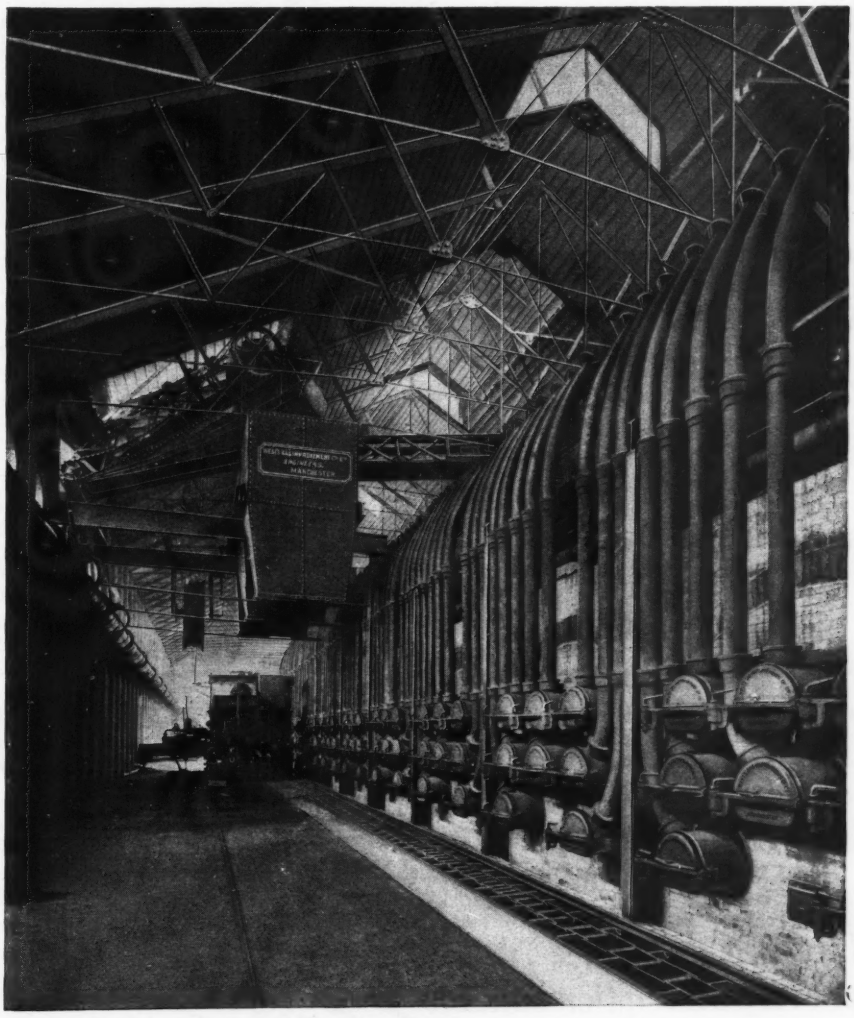
West's combined Charging and Drawing Machines.

The "Bournemouth" Arch Pipe

(WOODALL, HEAD, AND GREEN'S PATENT).

The "Hovey" Indicator

is fitted to the overhead Coal-Hoppers for gauging the depth of Coal contained in them.



With the **WEST'S COMBINED CHARGING AND DRAWING MACHINE** all classes of coal can be efficiently dealt with, and it requires only One Machine Driver and One Attendant to charge and draw the Retorts, attend to the Mouthpieces, and fill the Furnaces.

COAL AND COKE BREAKING, ELEVATING, AND STORING PLANTS.

BELTON'S PATENT AUTOMATIC RELIEF APPARATUS FOR HYDRAULIC MAINS.

Manufacturers for America: Riter-Conley Manufacturing Company, Pittsburg.

BOWENS' Ltd. Successors,
STOURBRIDGE.

MANUFACTURERS OF
BEST FIRE-BRICKS; INCLINED, HORIZONTAL, and SECTIONAL RETORTS; LUMPS, TILES, &c., of every description.
ESTABLISHED 1860.

RED BAND
UNBREAKABLE
INCANDESCENT MANTLE
Made in England, by a secret process, from 3-ply Ramie and strengthened to prevent breakage, 100-Candle power.
OUTSHINES & OUTLASTS ALL OTHERS.
Sample Dozen, post free 3/6.
LAW, 11, New Market St., BLACKBURN.

TIMMIS'S PATENT
CLINKERING DOOR.
For Illustrated Advertisement, with full Particulars, see "JOURNAL" for April 4, p. 66.
GEO. H. TIMMIS,
River Stour Works, STOURBRIDGE.
Telegrams: "TIMMIS, LYE." National Telephone: 13, LYE.
or of **HARPER & MOORES, LTD.,**
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Gasholders
AND
GAS PLANTS.
Tanks,
CAST-IRON AND STEEL.
Patent Pressed Steel Tanks from Stock.
HUMPHREYS & GLASGOW'S CARBURETTED WATER-GAS PLANTS.
Steel Structures
of every description.
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Telegrams: "ATLAS, B'HM." **BIRMINGHAM.** Telephone: B'HM: 86 & 4546.
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Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.
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These Patent Machine-Made Retorts possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made. *Retorts carefully Packed for Export.*
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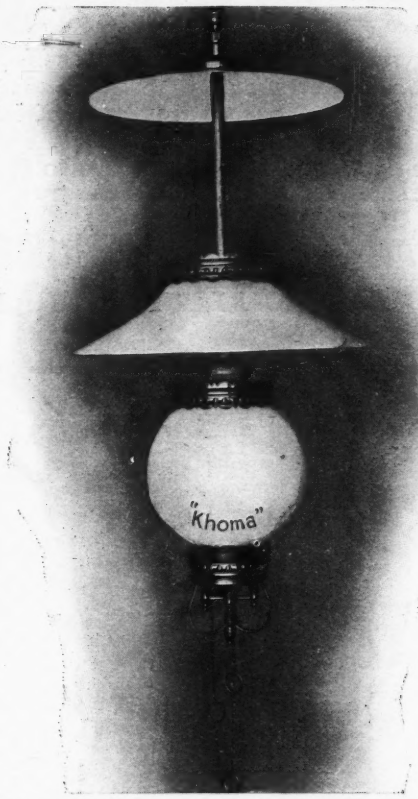
For Interior Lighting.

The only Lamp on the Market in which the Gas is properly heated and expanded before it reaches the Burner.

Imitations have not this Super-Heating Chamber for the Gas.

There are some people who have doubts as to the value of heating the gas used for incandescent lighting preliminary to combustion. The question may be simply settled, each one for himself, by comparative photometrical tests. The idea has received the support of many careful scientific investigators. Among the latest to carry their researches into this particular field are Drs. F. Haber and F. Richardt, whose valuable dissertation on "The Bunsen Flame, and Methods for the Chemical Determination of Flame Temperatures" was noticed at some length in the "JOURNAL OF GAS LIGHTING" for the 31st of January. Being towards the end of that article, it may have escaped the attention of some readers that there these investigators said: "The temperature of combustion of a gaseous mixture may be raised by a preliminary warming of the gas at the expense of the combustion products (as in regenerative furnaces), but not at the expense of the burning gas itself—that is to say, by subsequent, but not simultaneous, warming."



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Our Super-Heating Chamber and Trap for Condensation or Impurities of the Gas are built on scientific and mechanical principles.

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CAPACITY OF PURIFIERS DOUBLED.
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CARBURETTED WATER GAS
Maximum Efficiency Guaranteed.
A LARGE NUMBER OF PLANTS IN OPERATION.

Every Requirement for Gas-Works.
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SPLENDID CARBONIZING RESULTS.

The "Gas World" Analyses of the Accounts of Gas Undertakings show that the **HIGHEST RESULTS** in **GAS MADE** and **GAS SOLD** per Ton of Coal Carbonized were obtained at **SCARBOROUGH**, where improved Klönne Retort Settings, constructed by us, are **SOLELY** in use. Many other Towns where these Settings have been adopted are also giving splendid results both as to Gas Made and Coke Sold.

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KLÖNNE SETTINGS A SPECIALITY. **High-Class Work only.**

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The Ideal Shop Light

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"Sydney" Lamp.

It is beautifully made, compact, and shadowless. It is perfection in Inverted Cluster Lights. There are no drawbacks. Get a sample and satisfy yourself.

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BY USING

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SILCO BRICKS prevent all settling of setting.

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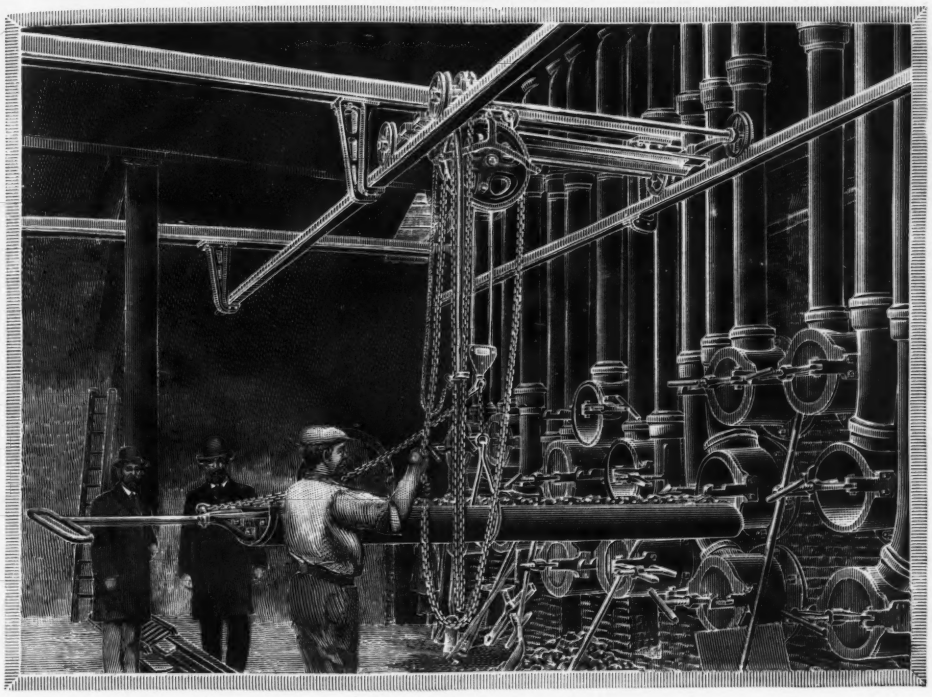

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The Features of the "SIMPLEX" PREPAYMENT METER.

NO REMOVAL OF METER.

NO Seals to hack out.
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NO reaching over Meter.
NO Numbers to look for.
NO Re-screwing.
NO Re-sealing.
NO bent Coin that is inserted into the Mechanism will jamb it.
NO second Coin can be inserted until previous one released by turning the handle.

TO CHANGE PRICE

merely unlock Padlock of Money Box, lift Flap at side, and change wheel.

THIS CAN BE DONE IN 30 SECONDS.

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Ordinary and Prepayment Meters can be converted into SIMPLEX Prepayment or Convertible Stops.

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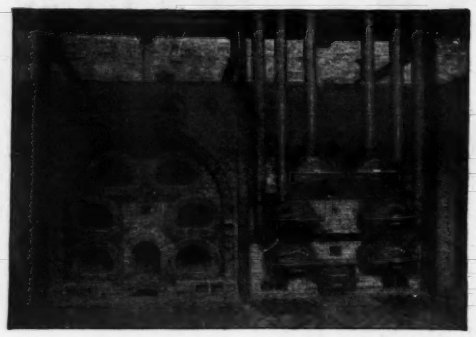

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REGENERATOR & GENERATOR SETTINGS

DEEP, SEMI-DEEP, AND SHALLOW.

Maximum Make per Ton and Mouthpiece.

Minimum Fuel Consumption.

NUMEROUS REPEAT ORDERS

Have been received for each of the above types of Settings.

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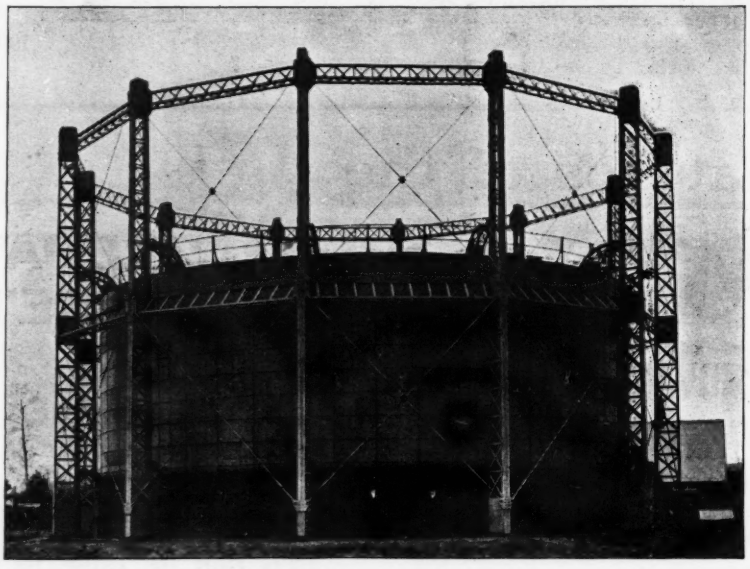

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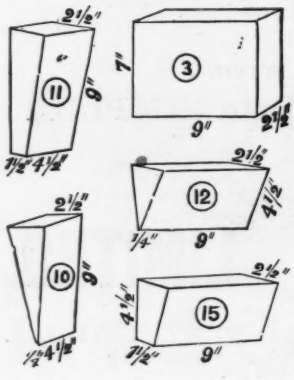

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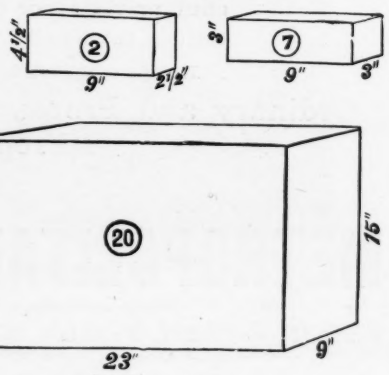

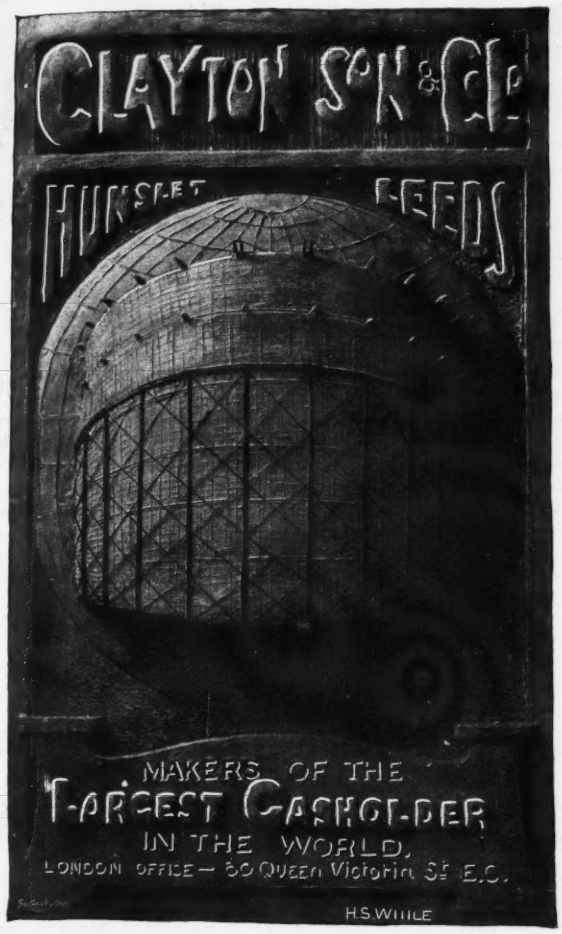

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including base, ring, and ladder rest.

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GAS, WATER, & STEAM TUBES AND FITTINGS.

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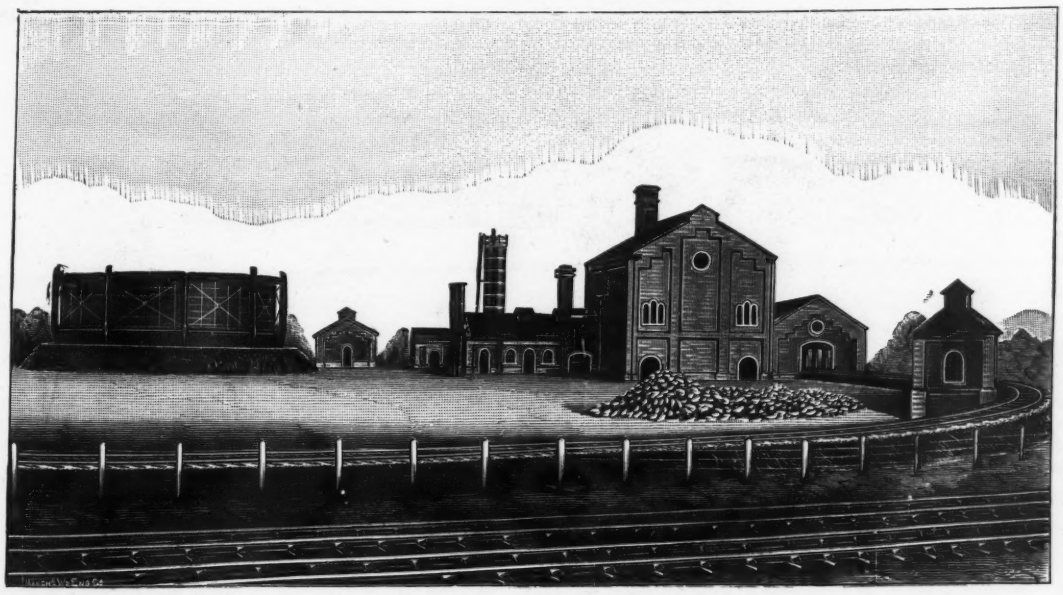

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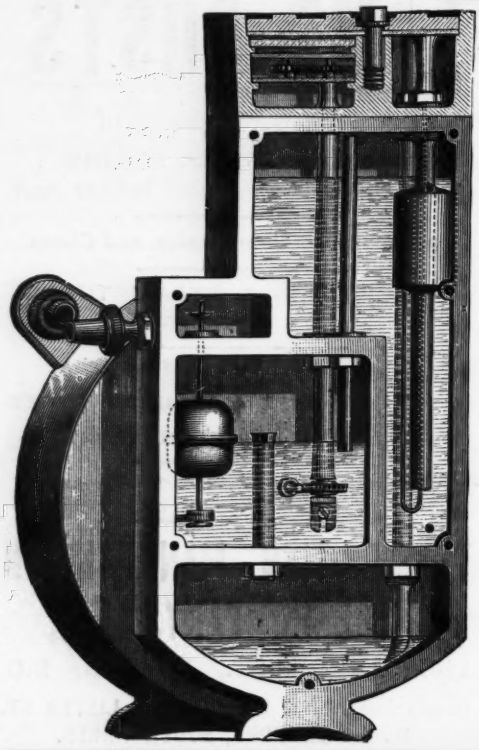

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Has been designed to obviate that which has hitherto prevented the general adoption of underground Meters—namely, their serious cost, No box is required; and the saving thus effected as compared with ordinary underground Meters, where either a box or meter-pillar is necessary, is fully one-half. The price of one for three lights is 28s.; and the other sizes are correspondingly cheap. When fixed, the only part of the Meter exposed to view measures 6½ inches by 8½ inches. By the Indicator with which the Meter is fitted, the Inspector can at once discern whether water is required; but as the Meter is of the compensating description, water will probably need only be supplied ONCE A YEAR. It is advisable to fill the Meter with a non-freezing liquid which does not injure the fittings; and this can be supplied at about 1s. 8d. per gallon.

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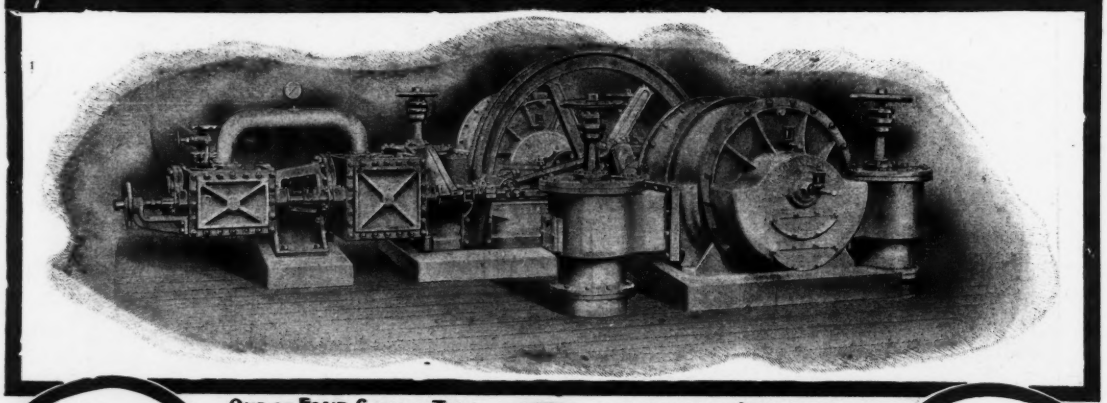

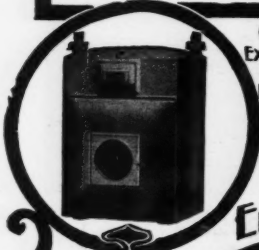

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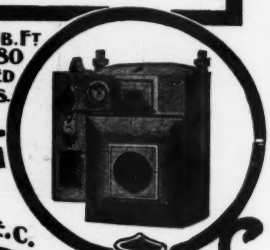

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